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SLUDGE INCINERATION MODELING (SIM) SYSTEM USER'S GUIDE

General Sciences Corporation
Laurel, MD

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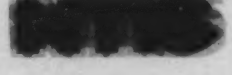

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GSC

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A user-friendly manual to faciliate operation of the Sludge Incineration Model for the incineration of sewage sludge under the proposed Part 503 regulations has been developed.

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Sludge Incineration Modeling (SIM) System User's Guide

Prepared for:

U. S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDES AND TOXIC SUBSTANCES
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TABLE OF CONTENTS

	Page No.
1. INTRODUCTION	1
2. SYSTEM REQUIREMENTS	2
3. LOADING THE SYSTEM	3
4. SCREEN DESIGN	6
5. FUNCTION KEYS AND COMMANDS	8
6. CHANGING SCREEN COLORS	10
7. SLUDGE INCINERATION MODELING (SIM) SYSTEM	14
8. BUILD ISCLT INPUT FILE	16
9. RUN ISCLT	24
10. SIM POST PROCESSOR	25
11. TERRAIN UTILITY	30
12. RUN CATALOG MANAGER	34
13. EXAMPLE PROBLEM	38
APPENDIX A	54

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1. INTRODUCTION

A user-friendly, menu-driven PC version of the Industrial Source Complex Long-Term (ISCLT) model has been implemented to support EPA regulation regarding incineration of sewage sludge under Section 405(d) of the Clean Water Act. The model will be made available to the public as part of the support for the proposed sewage sludge incineration regulation.

The Sludge Incineration Modeling (SIM) system comprises five components: 1) Build ISCLT Input File, 2) Run ISCLT, 3) SIM Post Processor, 4) Terrain Utility, and 5) Run Catalog Manager. The purpose of this user's guide is to describe how to use the components of the SIM system. Instructions on how to load the system and descriptions of screen design, system functions, and commands are given. General information on the ISCLT model and detailed descriptions of the SIM components are given. Finally, a case example is presented.

2. MINIMUM SYSTEM REQUIREMENTS

In order to work, the system requires the following items:

IBM XT/AT or compatible with 640K RAM.

Hard Disk and one floppy disk drive.

DOS Version 2.2 or higher version of DOS.

8087 or 80287 Math Co-Processor

Graphics display adapter

3. LOADING THE SYSTEM

The SIM system is contained on nine disks. The size of the system makes it impractical to run it from a floppy disk drive. You will thereby have to load the system before you begin. The nine disks to be loaded on the hard disk before you begin are:

Disk 1

SIM.BAT
SLUDGE.EXE
SLUDGE1.HLP
SLUDGE1.TAB

Disk 2

BUILDISC.EXE
SLUDGE2.HLP
SLUDGE2.TAB
SIM.FIG

Disk 3

ISCLT.EXE

Disk 4

ISCLTPP.EXE
UTILITY.HLP
UTILITY.TAB

Disk 5

TERRAIN.EXE
TERRAIN.HLP
TERRAIN.TAB

Disk 6

CATMGR.EXE
CATMGR.HLP
CATMGR.TAB
CATHLP.DAT

Disk 7

MODELOUT.EXE
XAUXIL.BIN
SSEL.DAT

Disk 8

STAR.BIN

Disk 9

ZIPCODE.BIN

When you load these disks on the hard disk, you are well advised to first create a separate subdirectory; although you may load the program onto the main directory with no adverse results. The files on disks one through seven should reside in the subdirectory from which you will run the SIM system. Disks eight and nine can be copied into a different subdirectory, if desired.

To create a subdirectory, enter "MD\SUBDIRECTORY" when you are in the C: drive:

C>MD\SUBDIRECTORYNAME

Once the directory is created, go to that directory by entering the following command:

C>CD\SUBDIRECTORYNAME

Once you are in the subdirectory or if you choose to load it on the main directory, copy the contents of the nine disks onto your hard disk by entering each disk on the A: drive and copying the contents of the disk:

C:\(SUBDIRECTORY)>COPY A:*.*

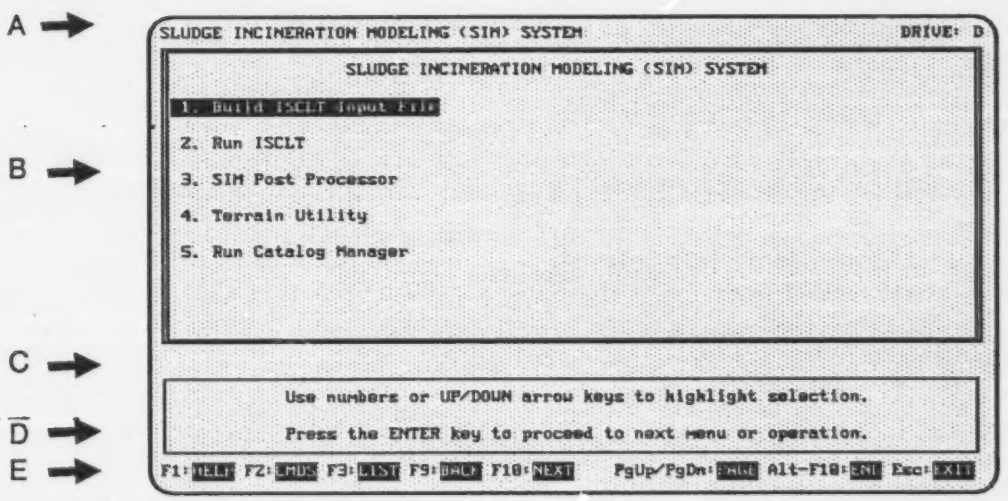
When the contents of all nine disks are on the hard disk, you are ready to begin your session.

Once you have completed the loading of the floppy disks onto your hard disk, you are ready to begin your session. Enter the execute command "SIM" to begin your session.

4. THE SCREEN DESIGN

The screens that you will encounter in this system were designed specifically to make interaction as simple as possible.

The menu screens in the SIM system have been divided into five sections. Each section imparts a different type of information. This division means that you will always know where to look to find system commands or other system information, and that you will know what kind of information the system is sending you just by where it occurs on the screen. An example of a menu screen is shown below.


A
B
C
D
E
SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
SLUDGE INCINERATION MODELING (SIM) SYSTEM
1. Build ISCLT Input File
2. Run ISCLT
3. SIM Post Processor
4. Terrain Utility
5. Run Catalog Manager
Use numbers or UP/DOWN arrow keys to highlight selection.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: CMDS F3: LIST F9: SHELL F10: NEXT PgUp/PgDn: SHELL Alt-F10: SHELL Esc: EXIT

A **Title Section** -- This section provides you with the system name and the default drive name.

B **User Interaction Section** -- This section is where the main user interaction occurs. There are two types of menus in the SIM system. Navigational menus like the one shown above have a list of options while parameter editing menus have a list of prompts with values or blank boxes attached to them requiring you to either enter new values or accept default values. To move in any direction in the menus, use the arrow keys on your numeric keyboard. (Note: For navigational

menus, you cannot use the left and right arrow keys). The cursor location is highlighted.

The help messages are also shown in this section, appearing in a window whenever you press the Help key (F1 key). The command keys and the help messages are explained in the following section. Help Messages are available for all prompts or options in all menus in SIM. Use them if you have the slightest doubt about what to enter. They will provide you with detailed information about the prompt on which your cursor rests.

C **Error Message Section** -- The third section is the error message area. If you do make an error in entering any input or if the program or dataset is not located in the file path that you specify, a message will appear in this area of the screen to tell that you have made an error and the type of error that you made. It is usually accompanied by a warning bell.

D **Instruction Section** -- This is the user message section. This part of the menu is to advise the user about the limitations of interaction. All operational instructions and acceptable user responses are displayed in this section. Special user input such as entering "YES" and "NO" in response to questions such as whether or not you wish to exit after you enter the EXIT function key (ESC) are also described in this section. Refer to this section to see how to select items and how to move from that particular menu to the next one.

E **Command Key Description Section** -- The fifth and last area of the SIM menu is the command keys section. It provides a list of the keys and their functions in the SIM system. However, you should keep in mind that certain programs such as the catalog manager require additional commands which are shown to you in the instruction section and in this section. If you do run into any program or entry error, you should consult the instruction section as well as the error message section.

5. FUNCTION KEYS AND COMMANDS

The SIM system has its own set of command keys (many of which are keyboard function keys) which allow you to navigate within menus and from menu to menu, and provide you with help or information about the system. Command keys that allow you to move through the system include F10, F9, ENTER and ESC. The arrow keys are used to move up and down within a menu. The arrow keys may also be used to move left and right when the parameter entry involves arrays. Help or information keys include F1, F2, and F3. The universal SIM system commands are listed below along with their functional description.

F1 This key retrieves help from the system for the item the cursor is on. Help messages exist for every item in every menu.

F2 Pressing this key gives you a brief explanation of the functions associated with the command keys shown in the command key description section.

F3 This key calls up the active catalog file. This catalog file lists the output and input datasets generated by any of the programs in the SIM system. (Do not confuse this with the catalog manager. The catalog manager allows you to update or change any of the entries in your current catalog and must be accessed using SIM menus.) You may only change the active catalog when using the F3 key. To see the catalog files in your directory, enter "A". You will see a table selection menu listing all the catalog files in your directory with the active catalog file highlighted. To select any of the catalog files, move your cursor to the appropriate catalog and press "S". You may also select a new catalog file by selecting the entry called "[NEW]". Changing the active catalog allows you to assign a specific file catalog to a specific session. Remember, however, that you should change the active catalog **before** the output files are created. To scroll up and down the catalog, use the Arrow keys. If your file is especially large, use the HOME key to go to the top of the file and the END key to go to the end of

file. To return to your current menu after viewing the catalog, press the F3 key again.

F9 This command key moves you back to the previous menu. If you are in the middle of a function, this command key allows you to return to the previous menu screen. To end a program, use the ALT/F10 command.

F10 This command key allows you to select items in a navigational menu after you have positioned your cursor over it by using either the arrow keys or by entering the item number. In other types of menus, this key is used to proceed to the next menu, after values for all required parameters have been entered. It performs the same function as the ENTER key.

ALT/F10 This command allows you to end a program and return to the previous navigational menu screen. When you are in the middle of a program and wish for some reason to abort it and return to a navigational menu, then this is the only way to do so without exiting SIM completely.

ESC To exit from the SIM system, use this function key. You will be asked whether you really wish to exit and you must answer "Y" for Yes before you may exit. This is to ensure that you did not accidentally hit the function key.

PgDn This command key allows you to move down a page when the menu has multiple pages.

PgUp This command key allows you to move up a page when the menu has multiple pages.

Remember, when in doubt, use the help messages; when you make an error, read the error message carefully; and when you want to move on, read the instruction section.

6. SIM CONFIGURATION FILE

The configuration file sets up the color scheme for the system and allows you to specify the location of the data files you loaded onto your system. To change the screen from black and white to color, you need to change the configuration file in SIM. This configuration file is contained on Disk 2 of the SIM system set and is called SIM.FIG. You may change it on the disk itself or on the hard disk after you have loaded the system. It is recommended that you change the file after you have loaded that system onto the hard disk as you will have a backup of the original configuration file. You will also need a data editor such as the Norton Editor in order to make changes.

Before you make any changes on the system, here is how the system works.

The SIM system, when activated, will first scan the host PC for a color card. After the scan, the configuration file is opened and the first line, the title line, is read into the system. If the system locates a color card on the PC, then it will read the second line in the file. If this line contains the word "color" than it will read the third line in the configuration file containing the color codes. For your information and to make changing the system as simple as possible, default color codes are already given in this line which you may assume. If you wish to change any of the color codes from the default to a different color, tables are given to help you locate the section of the screen that a code effects and the color the code stands for. The default configuration file is shown below.

You will notice that the default for the second line is "Unknown." This sets the screen to black and white, no matter what the scan of the host PC picks up. To set the system to color, you need only to enter "color." The first line is the title line for all the screens. You may change this if you wish to. The third line contains the color codes. The colors that these codes stand for and other color codes that you may also enter are given in the second table. You will notice the line of the numbers below the color code line. The 18 numbers are meant to be used as cross-reference to the 18 color codes found on the third line of the configuration file. The fourth line in the configuration file is not used; however, the line should remain. We have put the numbers 1 through

```
SLUDGE INCINERATION MODELING (SIM) SYSTEM
UNKNOWN
 10  0 14  3 15  4 15  1  12  0 15  2 15   0 15  0  15  4
* 1  2   3  4  5  6   7  8   9 10 11 12 13 14 15 16 17 18
Data path can be entered on this line

C*************************************************************************
C ITEM        COLOR       COLOR CODE  DESCRIPTION
C ===         =====       ========    ===========
C  1          LIGHT GREEN   10        SYSTEM TITLE FOREGROUND
C  2          BLACK         00        SYSTEM TITLE BACKGROUND
C  3          YELLOW        14        MAIN WINDOW FOREGROUND
C  4          CYAN          03        MAIN WINDOW BACKGROUND
C  5          WHITE         15        ERROR WINDOW FOREGROUND
C  6          RED           04        ERROR WINDOW BACKGROUND
C  7          WHITE         15        INSTRUCTION WINDOW FOREGROUND
C  8          BLUE          01        INSTRUCTION WINDOW BACKGROUND
C  9          LIGHT RED     12        FUNCTION KEY FOREGROUND
C 10          BLACK         00        FUNCTION KEY BACKGROUND
C 11          WHITE         15        FUNCTION KEY DESCRIPTION FOREGROUND
C 12          GREEN         02        FUNCTION KEY DESCRIPTION BACKGROUND
C 13          WHITE         15        HIGHLIGHT FOREGROUND
C 14          BLACK         00        HIGHLIGHT BACKGROUND
C 15          WHITE         15        EDITED ITEM ATTRIBUTE (EDIT MENUS)
C 16          BLACK         00        DEFAULT VALUES ATTRIBUTE (EDIT MENUS)
C 17          WHITE         15        HELP WINDOW FOREGROUND
C 18          RED           04        HELP WINDOW BACKGROUND
C*************************************************************************

C*************************************************************************
C  ATTRIBUTES FOR IBM COLOR GRAPHICS DISPLAY
C
C  COLOR              COLOR CODE
C  =====              ==========
C  BLACK                   0
C  BLUE                    1
C  GREEN                   2
C  CYAN                    3
C  RED                     4
C  MAGENTA                 5
C  BROWN                   6
C  LIGHT GRAY              7
C  DARK  GRAY              8
C  LIGHT BLUE              9
C  LIGHT GREEN            10
C  LIGHT CYAN             11
C  LIGHT RED              12
C  LIGHT MAGENTA          13
C  YELLOW                 14
C  WHITE                  15
C*************************************************************************
```

18 on the fourth line so that you will understand the correspondence of the color codes. This line should not be deleted for any reason. The fifth line and last line of the configuration file can be used to specify the path or paths to the SIM data files that you loaded onto your system. They should be entered if you chose to enter the datafiles in a directory other than the SIM subdirectory. To enter the path to your directory, follow the same rules you used in entering the DOS file path statement in your AUTOEXEC.BAT file. An example is provided below:

C:\STAR;D:\ZIPCODE;

You should always have a semicolon (;) separating one directory from the other. In entering your directories in the datapath, substitute the names and locations of your directories for the example names given above.

The rest of the file is there to help you if you wish to change the color. There are a few rules to remember when changing the colors in the configuration file.

- Your PC must have a color card.
- You may enter only those color codes that are given in second table.
- You must leave a space separating each color code.
- You must already possess a data editor or a word processor with a non-document mode.

Here is how you would change the colors in the configuration file (This sequence assumes that you possess either a data editor or a word processor with a non-document mode and that you have already called up the configuration file, SIM.FIG, on that editor.)

1) Change the second line to color if you wish the screen to be in color. To change the screen back to black and white or monochrome, you need only leave this line blank or change it back to the default "Unknown."

2) Either assume the default color codes for the third line or enter the color codes for the color you want a section to be. Refer to the two tables to see the colors the codes represent and the sections that they apply to. If you wish

to change any of the colors, refer to the first table to see where in the sequence of codes the section that you wish to effect lies. Then refer to the second table to see which code represents the color that you would like the section to be. When you have found it, enter the code in place of the existing code. You may change any of the existing sections of the screen into any color that you wish. You may even change the entire screen to black and white but the second line must read "color." Remember, however, to always leave at least one space separating one code from the other on the third line. Enter the color codes just as they appear in the second table.

7. SLUDGE INCINERATION MODELING (SIM) SYSTEM

The version of ISCLT implemented in the SIM system is version 86324 corresponding to letter change 2 of UNAMAP Version 6. A brief model overview of ISCLT is followed by a description of the primary selection menu of the SIM system.

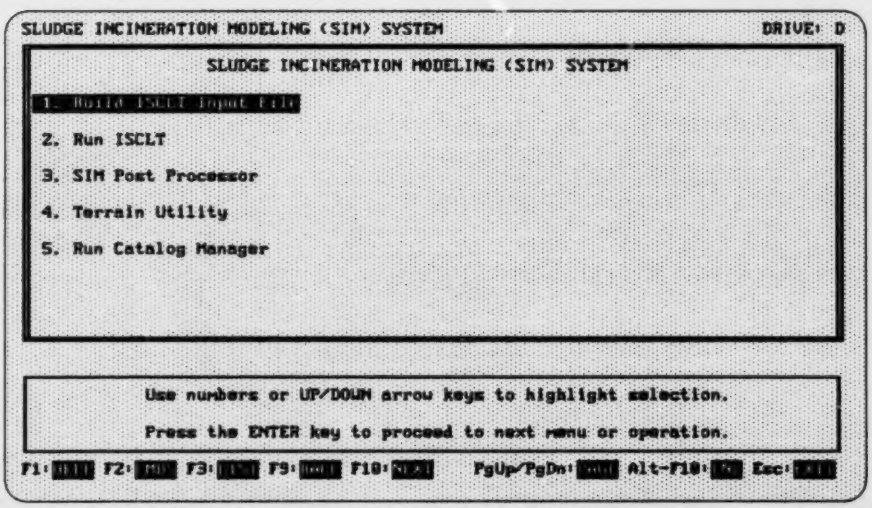
ISCLT is a sector-averaged model that extends and combines basic features of the Air Quality Display Model (AQDM) and the Climatological Dispersion Model (CDM). The long-term model uses statistical wind summaries to calculate annual ground-level concentration or deposition values. The area surrounding a continuous source of pollutants is divided into sectors of equal angular width corresponding to the sectors of the annual frequency distribution of wind direction, wind speed, and stability. Annual emissions from the source are partitioned among the sectors according to the frequencies of wind blowing toward the sectors. The ground-level concentration fields calculated for each source are translated to a common coordinate system (either polar or Cartesian as specified by the user) and summed to obtain the total due to all sources.

ISCLT has the option to include terrain effects for concentration calculations only. It should be noted that the model truncates terrain to 0.005 meters below the stack height. For plumes comprising particulates with appreciable gravitational settling velocities, the ISCLT model accounts for the effects on ambient particulate concentrations of gravitational settling and dry deposition. Alternatively, the ISCLT model can be used to calculate dry deposition.

Only the stack source type portion of the ISCLT model is implemented in the SIM system. The steady-state Gaussian plume equation for a continuous source is used to calculate ground- level concentrations for the stack sources. The generalized Briggs plume-rise formulas are used to calculate final as well as gradual plume rise. Procedures are used to evaluate the effects of the aerodynamic wakes and eddies formed by buildings and other structures on plume dispersion. A wind-profile exponent law is used to adjust the observed mean wind speed from the measurement height to the emission height for the

plume rise and concentration calculations. Procedures utilized by the Single Source (CRSTER) model are used to account for variations in terrain height over the receptor grid. The ISCLT model has one rural and three urban options, but Urban Modes 1 and 2 are not implemented as per the recommendation from the Office of Air Quality Planning and Standards (OAQPS) of the EPA. The Rural Mode uses the Pasquill-Gifford curves to calculate lateral and vertical plume spread. In Urban Mode 3, the Briggs urban dispersion coefficients derived from McElroy-Pooler observations are used. A complete technical discussion of the ISCLT model may be found in volume I of the Industrial Source Complex (ISC) Dispersion Model User's Guide - Second Edition (EPA - 450/4-86-005).

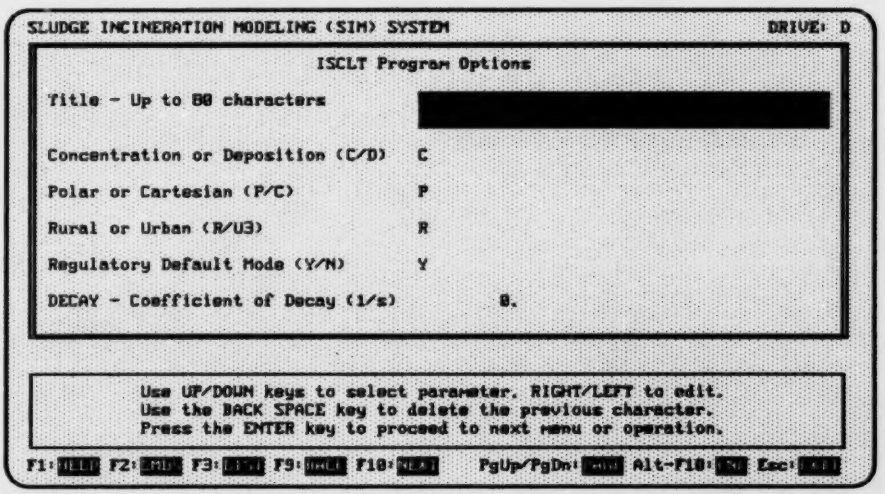
The screen shown below illustrates the primary navigational menu of the SIM system. Component 1 is a sequence of menu screens which allows you to set up your modeling scenario and create the required ISCLT model input file. Component 2 runs the ISCLT model. A file of results from the run is created for use by the SIM post processor (component 3). The post processor estimates the the allowable pollutant concentration in the sludge (ppm) for 8 pollutants. Component 4 is used to create a file of terrain elevations at each receptor point. This utility is not required if you are going to use the ISCLT program as a flat terrain model. **The terrain utility must be run prior to component 1 if you want to include terrain in your modeling scenario**. Component 5 is used to run the Catalog Manager. The Catalog Manager allows you to manage files created by the SIM system. The next five sections of the user's guide describe how the system proceeds when you select each of the respective SIM components.



8. BUILD ISCLT INPUT FILE

A sequence of menu screens are displayed which allows you to set up your modeling scenario. Default values are supplied for the menu items and may be changed at your discretion. The required ISCLT model input file is created by the system.

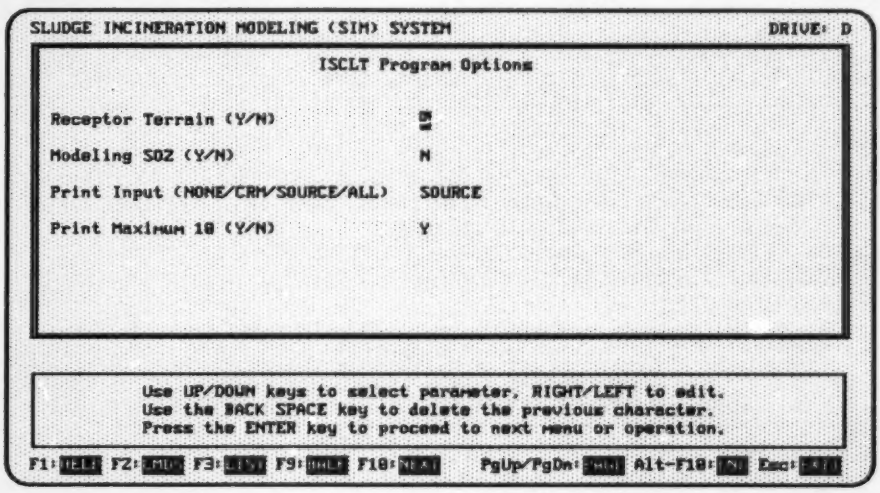
The first menu screen for this SIM system component (see example of defaulted menu below) contains option switches for calculating concentration or deposition, using a polar or Cartesian grid system, using rural or urban mode, and modeling under the regulatory default mode. Details concerning any of these model options are available via use of the help function key F1. The title and a value for the decay coefficient are also elements of the first menu.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
ISCLT Program Options
Title - Up to 80 characters
Concentration or Deposition (C/D) C
Polar or Cartesian (P/C) P
Rural or Urban (R/U3) R
Regulatory Default Mode (Y/N) Y
DECAY - Coefficient of Decay (1/s) 0.
Use UP/DOWN keys to select parameter. RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1:
F2:
F3:
F9:
F10:
PgUp/PgDn:
Alt-F10:
Esc:

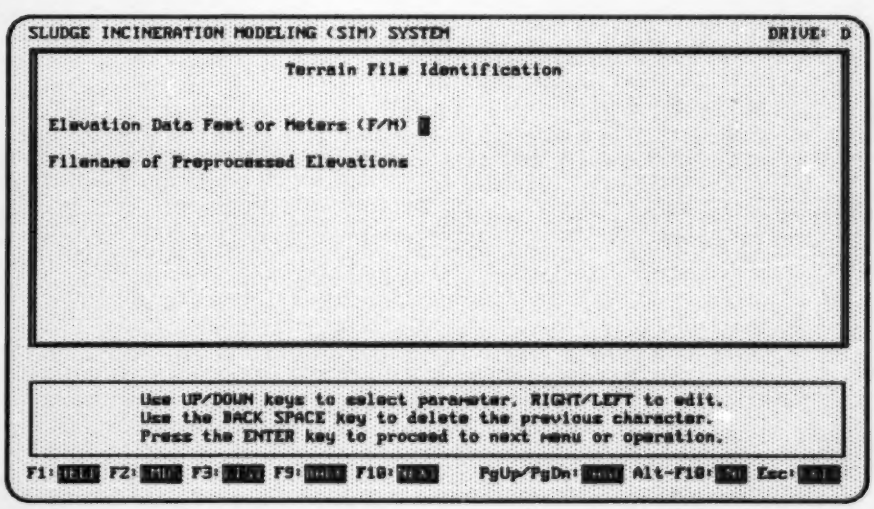
The items in the second screen depend on the options selected in the first menu. The type of input data to be printed in the ISCLT model output and the option to print the maximum 10 values are common to all of the possible second screens. If you are modeling under the regulatory default mode, this screen also contains a YES/NO item to indicate whether you are modeling sulfur dioxide. If you are not under the regulatory default mode, the screen contains YES/NO indicators for calculating plume rise as a function of distance, for including the Briggs stack-tip downwash corrections, and for accounting for

buoyancy-induced dispersion. Again, help is available for all menu items by simply pressing the F1 function key.

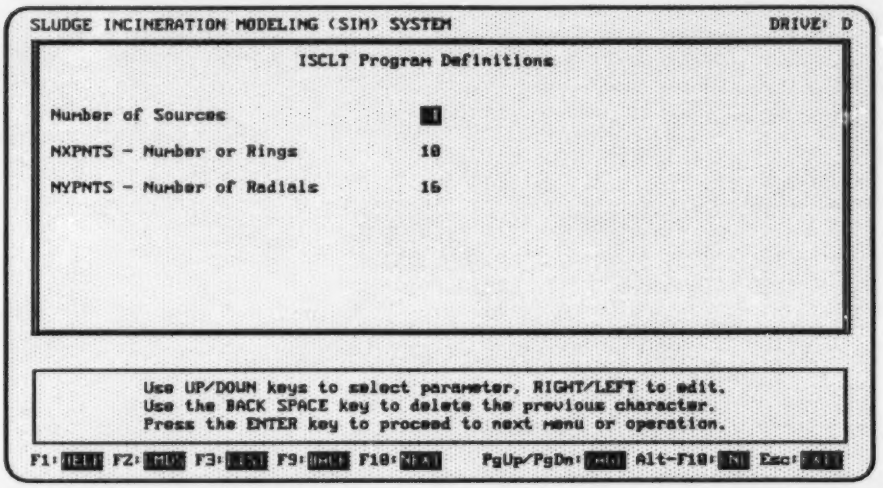
The option switch to indicate whether you want to include terrain elevations in your modeling scenario is included in the second screen if you are calculating concentrations. It is not included if you are calculating total deposition. The following menu screen is an example of the second screen when all items in the first menu are defaulted. Note that using terrain elevations has been indicated.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
ISCLT Program Options
Receptor Terrain (Y/N) Y
Modeling SO2 (Y/N) N
Print Input (NONE/CRM/SOURCE/ALL) SOURCE
Print Maximum 10 (Y/N) Y
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: EDIT F9: RUN F10: NEXT PgUp/PgDn: MENU Alt-F10: DOS Esc: EXIT

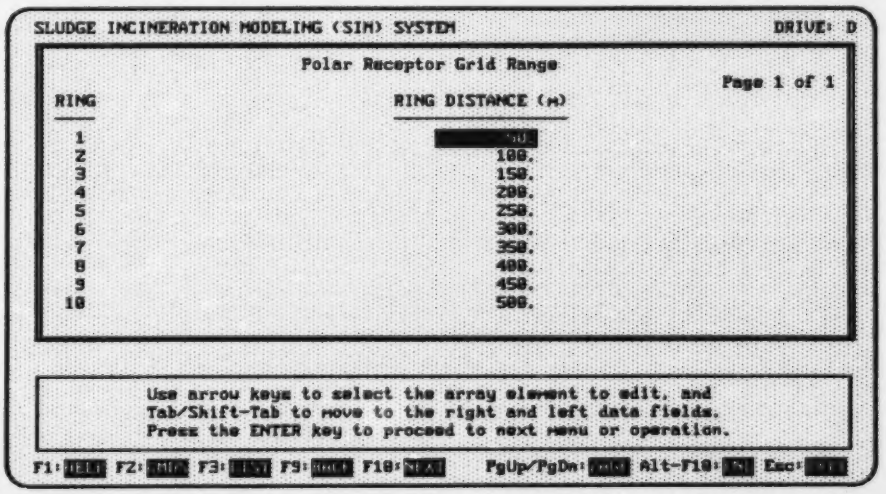
If terrain is indicated, the following menu appears for identifying the terrain data. You must confirm the units of the elevations and enter the file name of the preprocessed terrain elevations file.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Terrain File Identification
Elevation Data Feet or Meters (F/M)
Filename of Preprocessed Elevations
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: EDIT F9: RUN F10: NEXT PgUp/PgDn: MENU Alt-F10: DOS Esc: EXIT

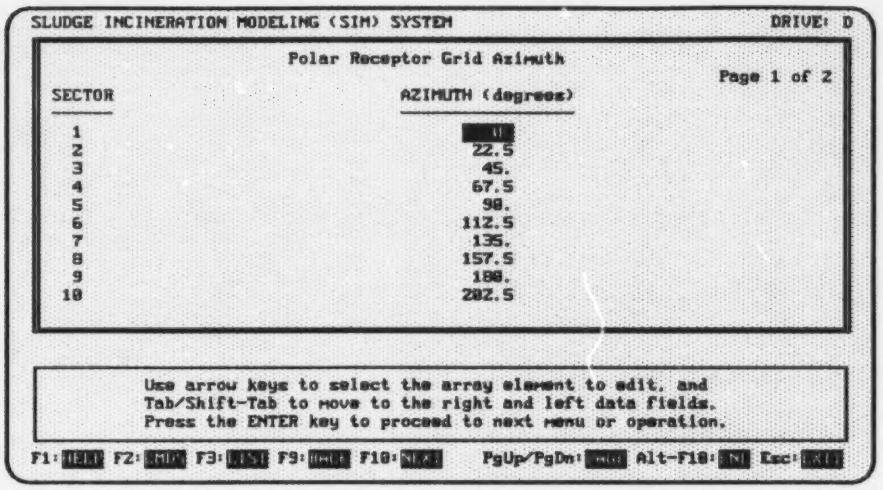
The next screen defines the number of sources you want to model for the facility as well as the number of rings and radials if you are using a polar grid system. If you are using a Cartesian grid, the number of X-axis and Y-axis grid receptors are defined. The following screen is an example of the default menu when a polar grid system is selected.

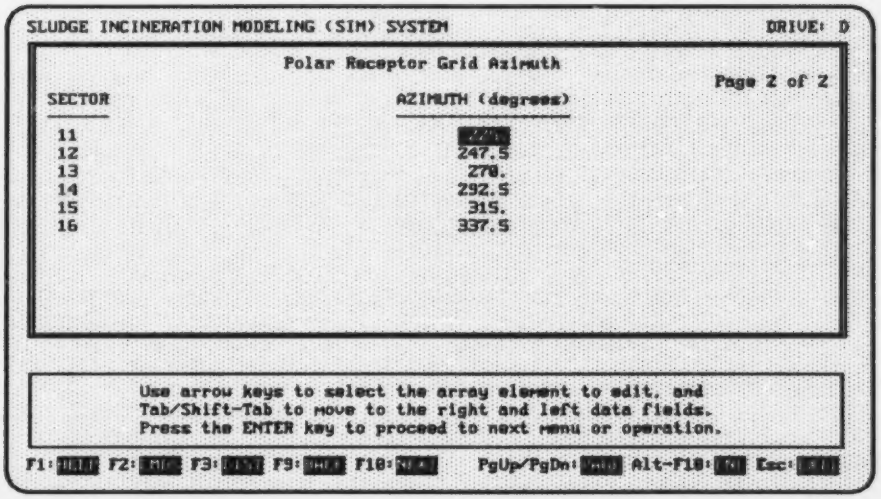

SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
ISCLT Program Definitions
Number of Sources 1
NXPNTS - Number or Rings 10
NYPNTS - Number of Radials 16
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MOD F3: EXT F9: CALC F10: NEXT PgUp/PgDn: MOD Alt-F10: INI Esc: EXIT

The next two sets of menu screens are used to enter the ring distances and azimuth values or X-axis and Y-axis grid distances depending on whether you are setting up a polar or Cartesian grid. If you do not change the default values for the number of these parameters given in the previous screen, the system will supply default values for these menu screens. If you do not use the default number of rings or X-axis and Y-axis grids, the system does not supply default distances. The azimuth values are always supplied. It should be noted that the system will not allow a ring distance of less than 50 meters. The following screen illustrates the default menu for polar receptor grid distances.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Polar Receptor Grid Range
Page 1 of 1
RING
RING DISTANCE (M)
1 50.
2 100.
3 150.
4 200.
5 250.
6 300.
7 350.
8 400.
9 450.
10 500.
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MOD F3: EXT F9: CALC F10: NEXT PgUp/PgDn: MOD Alt-F10: INI Esc: EXIT

The following two screens illustrate the default menu for the polar receptor grid azimuth values.

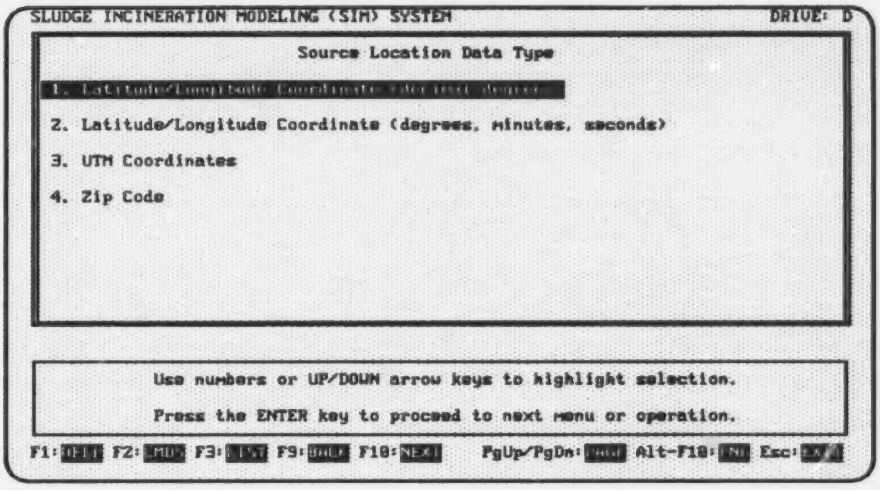

SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Polar Receptor Grid Azimuth
Page 1 of 2
SECTOR
AZIMUTH (degrees)
1 0
2 22.5
3 45.
4 67.5
5 90.
6 112.5
7 135.
8 157.5
9 180.
10 202.5
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: EDIT F3: LIST F9: CALC F10: MAIN PgUp/PgDn: PAGE Alt-F10: INI Esc: EXIT


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Polar Receptor Grid Azimuth
Page 2 of 2
SECTOR
AZIMUTH (degrees)
11 225.
12 247.5
13 270.
14 292.5
15 315.
16 337.5
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: EDIT F3: LIST F9: CALC F10: MAIN PgUp/PgDn: PAGE Alt-F10: INI Esc: EXIT

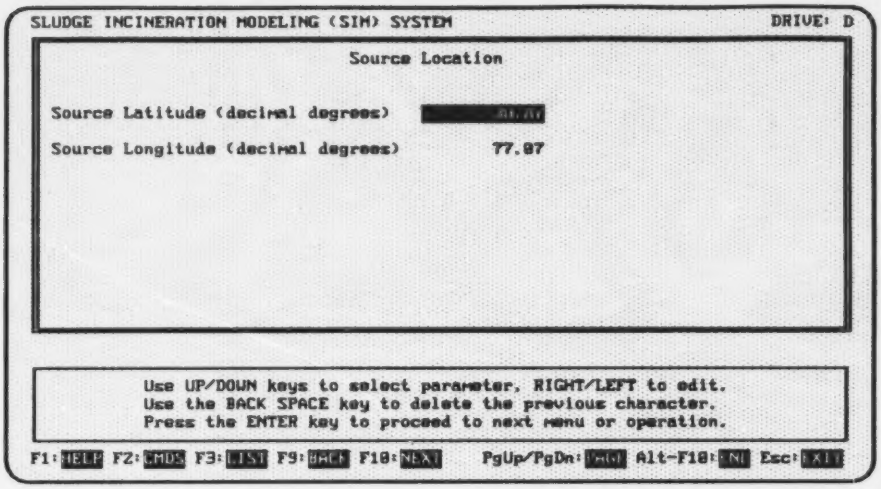
The next three menu screens are used to determine which set of annual STability ARray (STAR) summaries and auxiliary meteorological data will be used in the ISCLT model input file. The STAR data are statistical tabulations of the joint frequency of occurrence of wind-speed and wind-direction categories, classified according to Pasquill stability categories. There are 392 data sets available in the SIM system. Mixing heights and ambient temperatures are also available for each of the STAR data locations and are used in the input file.

The first step in selecting the meteorological data is to identify what type of location information you have for the facility. The system can accept four types of location data: 1) latitude/longitude coordinates in decimal degrees, 2) latitude/longitude coordinates in degrees, minutes and seconds, 3) UTM coordinates, and 4) zip code.

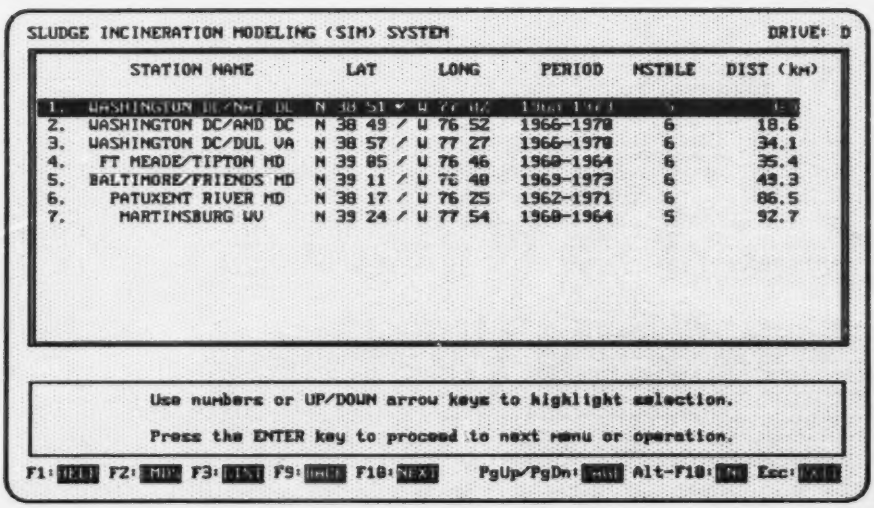
The following screen is an example of the menu presented for selection of the source location data type.



The next screen that appears is for entering the location information for the facility. The menu contains items consistent with your selection in the previous menu, that is, latitude/longitude values in decimal degrees or degrees, minutes, and seconds; UTM zone with northing and easting; or the U.S. postal zip code. The following screen is an example of the decimal degrees latitude/longitude menu.

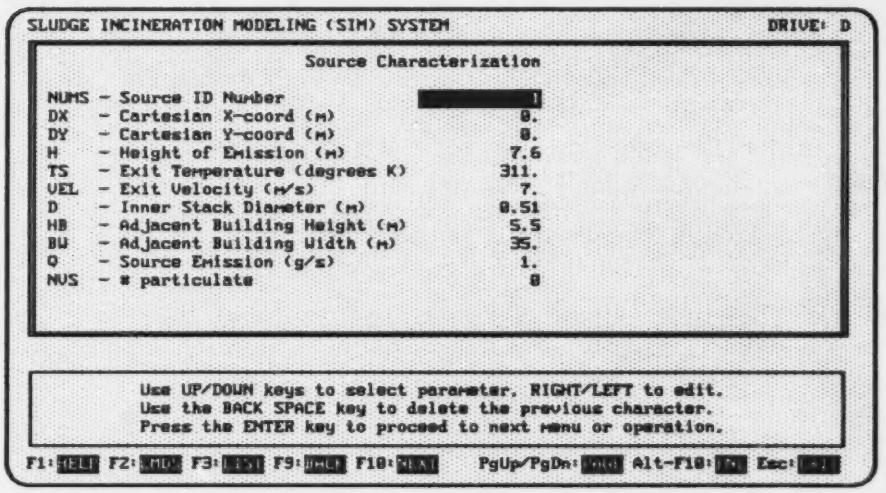

SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Source Location
Source Latitude (decimal degrees)
Source Longitude (decimal degrees) 77.07
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: CMDS F3: LIST F9: SHCH F10: NEXT PgUp/PgDn: Prev Alt-F10: MN Esc: EXIT

Based on the latitude/longitude supplied, the latitude/longitude corresponding to the UTM coordinates, or the latitude/longitude for the zip code, the system next presents a selection menu of nearby locations where STAR and auxiliary meteorological data are available. The list is arranged according to distance from the facility. You should select the station which best represents the climatology of the area. If you are unsure as to which is most appropriate, just press the ENTER key to select the closest one. However, it should be noted that factors such as complex terrain or proximity to a land/water interface should be considered in making this selection. The following is the meteorological data that appears in response to the latitude/longitude coordinates entered in the previous screen.

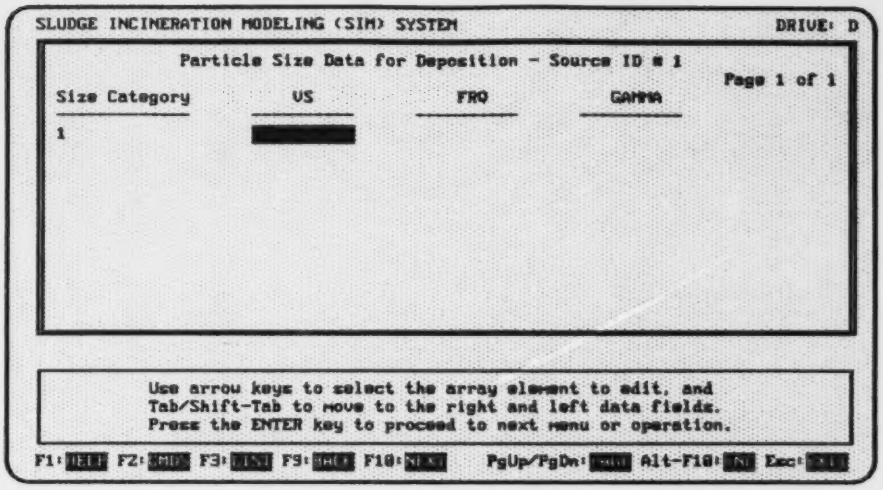

SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
STATION NAME LAT LONG PERIOD MSTBLE DIST (km)
1. WASHINGTON DC/NWS DC N 38 51 / W 77 02 1961-1964 5 0.0
2. WASHINGTON DC/AND DC N 38 49 / W 76 52 1966-1970 6 18.6
3. WASHINGTON DC/DUL VA N 38 57 / W 77 27 1966-1970 6 34.1
4. FT MEADE/TIPTON MD N 39 05 / W 76 46 1960-1964 6 35.4
5. BALTIMORE/FRIENDS MD N 39 11 / W 76 40 1969-1973 6 49.3
6. PATUXENT RIVER MD N 38 17 / W 76 25 1962-1971 6 86.5
7. MARTINSBURG WV N 39 24 / W 77 54 1960-1964 5 92.7
Use numbers or UP/DOWN arrow keys to highlight selection.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: CMDS F3: LIST F9: SHCH F10: NEXT PgUp/PgDn: Prev Alt-F10: MN Esc: EXIT

The source characterization data are entered in the next menu. The following parameters will always appear regardless of whether you are calculating concentration or deposition, and whether terrain is included: source X Cartesian coordinates (DX), source Y Cartesian coordinates (DY), source ID number (NUMS), height of emission (H), stack gas exit temperature (TS), exit velocity (VEL), stack diameter (D), adjacent building height (HB), maximum projected width of the adjacent building (BW), source emission rate (Q), and number of particulates size categories (NVS). The default values for H, TS, VEL, D, HB, BW, and Q are tier 1 values used for sewage sludge incinerators. **It should be noted that the sum of the values for Q must be equal to 1.0 for the SIM post processor to be used correctly.** If you include terrain in the modeling, the source elevation (ZS) appears.

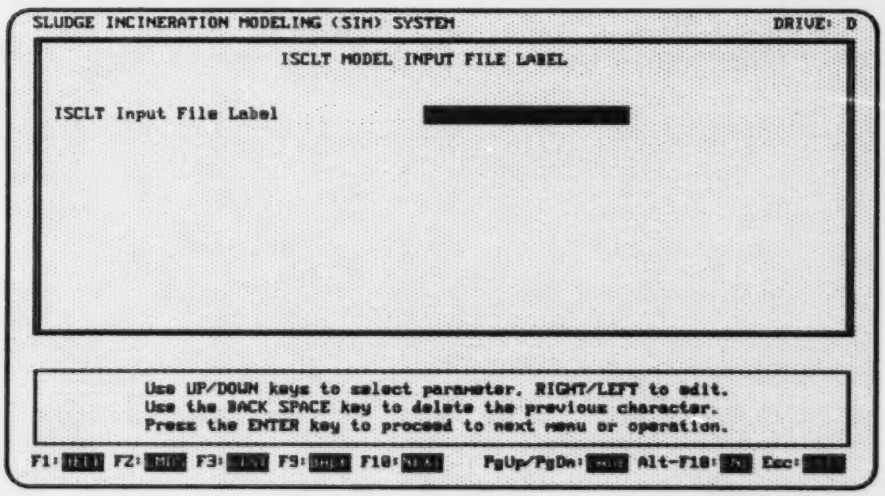
The following screen shows the default screen for a modeling scenario using a polar grid without terrain.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Source Characterization
NUMS - Source ID Number 1
DX - Cartesian X-coord (m) 0.
DY - Cartesian Y-coord (m) 0.
H - Height of Emission (m) 7.6
TS - Exit Temperature (degrees K) 311.
VEL - Exit Velocity (m/s) 7.
D - Inner Stack Diameter (m) 0.51
HB - Adjacent Building Height (m) 5.5
BW - Adjacent Building Width (m) 35.
Q - Source Emission (g/s) 1.
NVS - # particulate 0
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1:HELP F2:MENU F3:TEST F9:UNCH F10:NEXT PgUp/PgDn:PAGE Alt-F10:TOP Esc:EXIT

A menu for entering values for the settling velocity (VS), the mass fraction of particulates (FRQ), and the surface reflection coefficient (GAMMA) for NVS particulates size categories appears if NVS is set to a value greater than zero. The following screen illustrates the menu which is used if you want to calculate ground-level deposition or concentration with deposition occurring. Up to 20 size categories can be specified for NVS. The sum of the FRQ values must be 1.0 and GAMMA can range from 0 (total retention) to 1 (complete reflection).



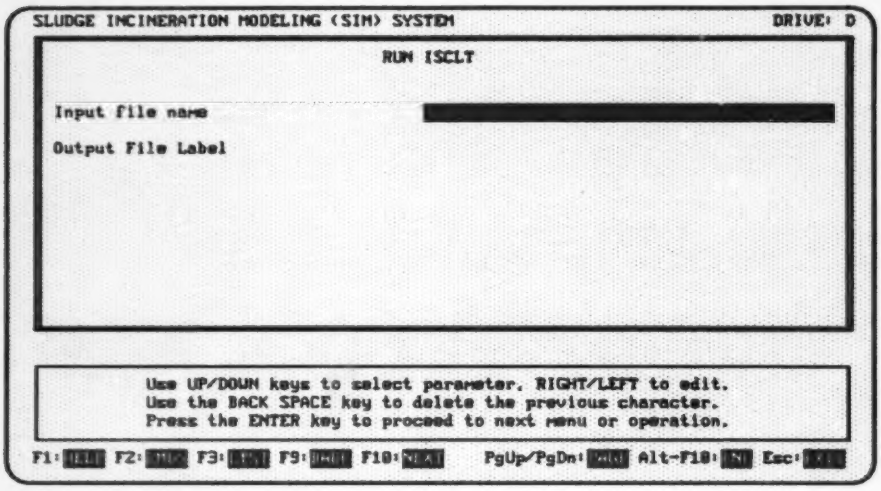
The last menu of the Build ISCLT Input File component requires entering an output file label. The path for the STAR station data which was previously selected is also required, if the STAR data file can not be located by the system. The following screen is an example of the last menu as it appears when the path for the STAR data is not required.



At this point, the ISCLT model input file is created and stored in the catalog file. The name of the file is the letters "ISCLT" followed by a numeric value. The numeric value is a unique identifier supplied by the system. The file extension is ".INP". The label you assign to the ISCLT input file will be the default label assigned to all subsequent output files from the Run ISCLT and SIM Post Processor components. The unique numeric identifier given to the ISCLT input file will also be assigned to the output files.

9. RUN ISCLT

This component simply runs a user-specified ISCLT model input file. The following screen appears when you select this component.



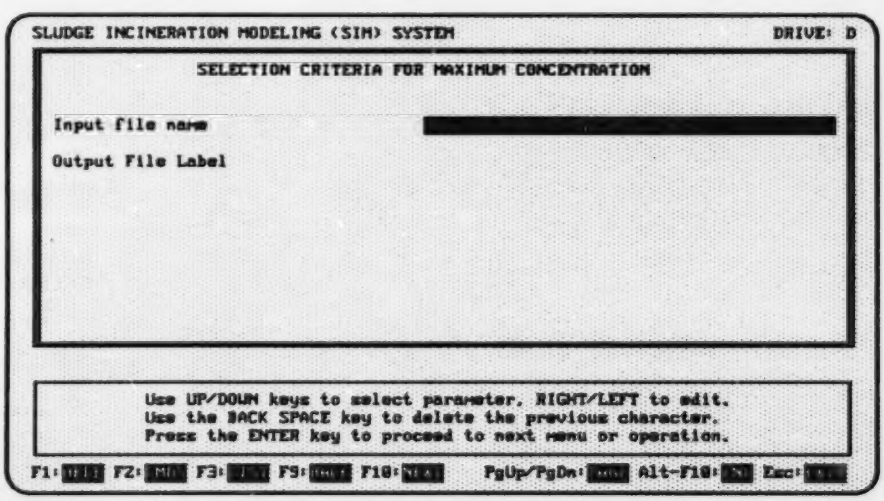
You must enter the name of the ISCLT input file you want to run. You can press the F3 function key to list the files in the active catalog. You are not required to enter the ".INP" extension.

Two files are created from this component. The first file contains standard ISCLT model output. This output file name consists of the letters "ISCLT" followed by a numeric value consistent with the ISCLT model input file. The file has a ".OUT" extension. A complete discussion of the output is given in the ISC model documentation. The second file contains the concentration estimates at each receptor grid. This output file name consists of the letters "ISCLT" follwed by a numeric value consistent with the ISCLT model input file. This file has a ".PP" extension. This file is accessed by the SIM post processor. If the output file label in the menu is left blank, the same label associated with the ISCLT model input file will be assigned to these two output files. Type in a label if you want to change it.

10. SIM POST PROCESSOR

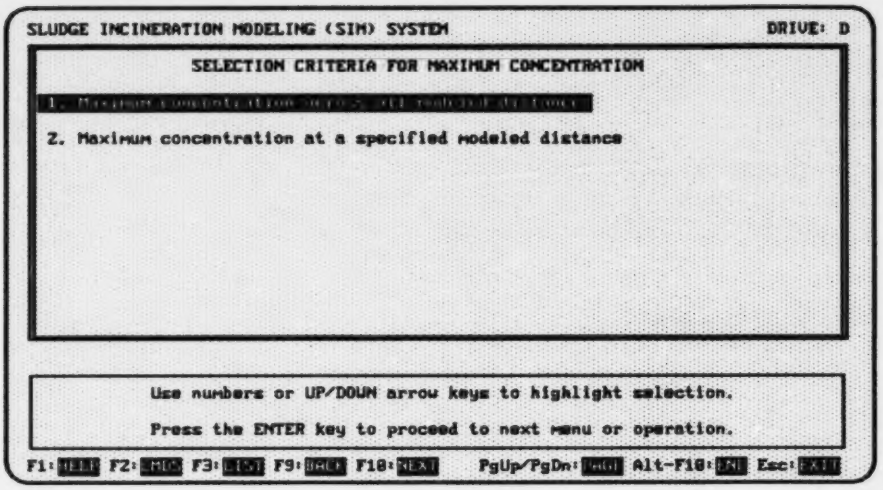
The SIM post processor is used to estimate the allowable pollutant concentration in the sludge for 8 pollutants. The concentration output file generated from running ISCLT is accessed and a maximum concentration estimate is determined. The post processor will only run on an output file generated by the ISCLT model when run in concentration mode (not deposition). Based on a feed rate input by the user and pollutant control efficiencies that may be changed, the SIM post processor presents on the screen, the allowable pollutant concentration in the sludge (ppm) for each pollutant. Appendix A details the calculation methods for estimating the allowable pollutant concentration in the sludge. The results are also written to a file. The user may enter a new feed rate to obtain additional estimates.

The first screen shown below requires the name of the input file to be used by the post processor. The input file is the concentration output file generated from running ISCLT. You can press the F3 function key to list the file in the active catalog. You are not required to enter the ".PP" extension. Leave the output file label blank if you want the same label associated with the post processor output file as with the model output files.

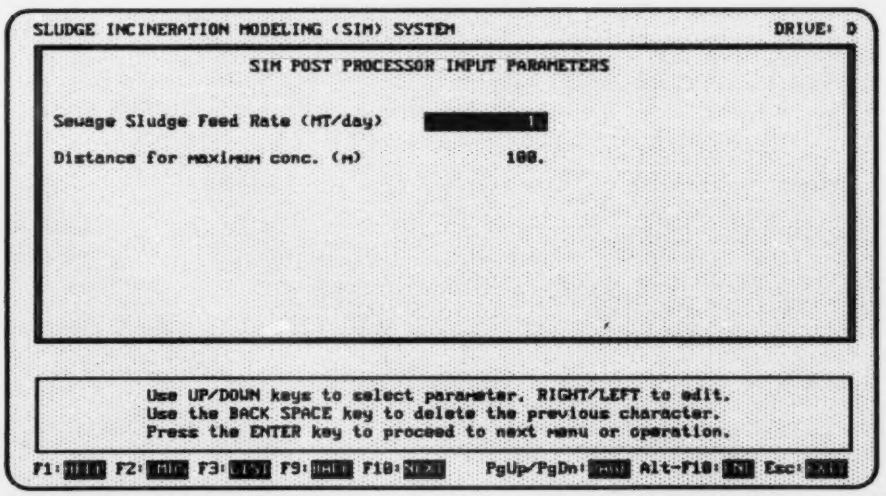


The following navigational menu appears next if you use a polar grid in your modeling. The maximum concentration estimates used in the

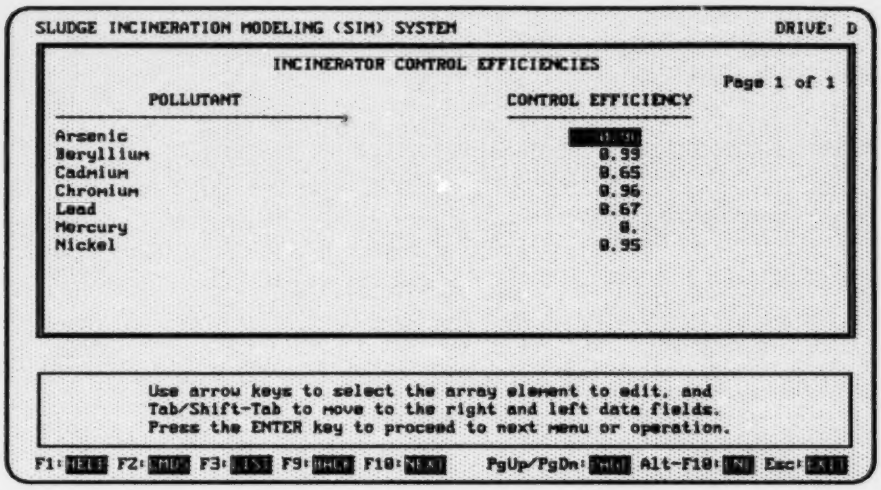
calculations can be obtained from the concentration estimates across all modeled ring distances or from the estimates at a specified modeled ring distance. If you use a Cartesian grid, the maximum concentration is obtained across all modeled X, Y grid pairs and the maximum concentration selection criteria menu does not appear.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
SELECTION CRITERIA FOR MAXIMUM CONCENTRATION
1. Maximum concentration at all modeled distances
2. Maximum concentration at a specified modeled distance
Use numbers or UP/DOWN arrow keys to highlight selection.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: EXIT F9: BACK F10: NEXT PgUp/PgDn: MENU Alt-F10: ENV Esc: EXIT

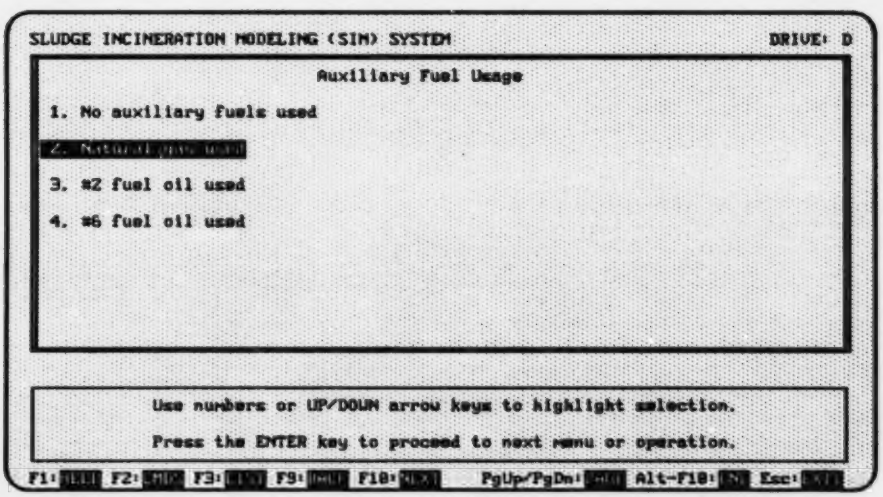
A dry feed rate in metric tons (dry weight) per day is input in the next screen. If your modeling was conducted using a polar grid and you elected to use a maximum concentration at a specified modeled ring distance, the distance for maximum concentration is also input in this screen. The example screen shown below contains both the dry feed rate and the distance for maximum concentration.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
SIM POST PROCESSOR INPUT PARAMETERS
Sewage Sludge Feed Rate (MT/day) 1
Distance for maximum conc. (m) 100.
Use UP/DOWN keys to select parameter. RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: EXIT F9: BACK F10: NEXT PgUp/PgDn: MENU Alt-F10: ENV Esc: EXIT

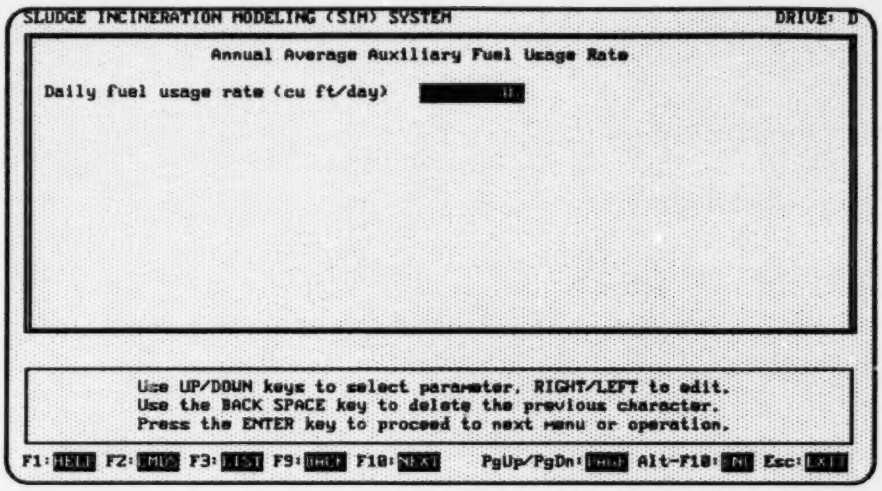
The post processor next presents a menu of pollutant control efficiencies for the 7 pollutants. Default values are supplied but you may change any or all the values. The following screen is an example of the default menu for the pollutant control efficiencies.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
INCINERATOR CONTROL EFFICIENCIES
Page 1 of 1
POLLUTANT
CONTROL EFFICIENCY
Arsenic
Beryllium 0.99
Cadmium 0.65
Chromium 0.96
Lead 0.67
Mercury 0.
Nickel 0.95
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: SHOW F3: TEST F9: CALC F10: NEXT PgUp/PgDn: SHOW Alt-F10: END Esc: EXIT

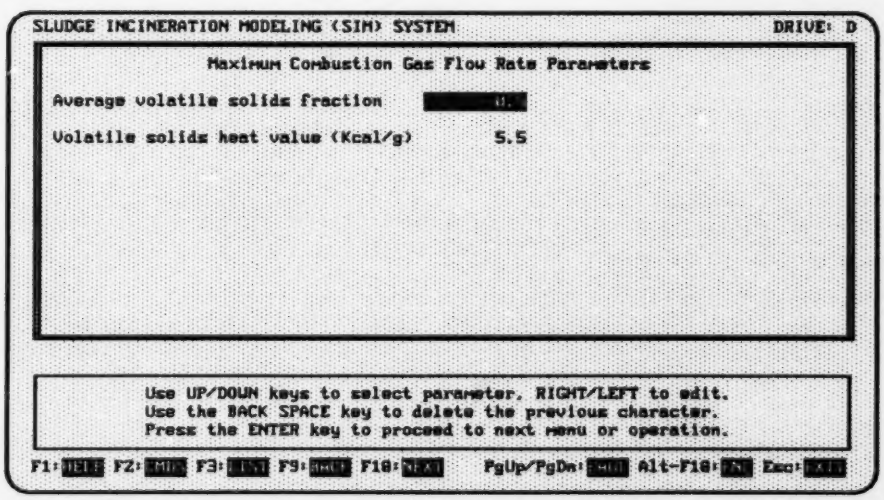
The next screen is a navigational menu used to indicate what type of auxiliary fuel, if any, is used in the sewage sludge incinerator. This information is used in the determination of the maximum combustion gas flow rate which is used in the calculation of the pollutant limit for total hydrocarbons (see Appendix A). Select the first item if no auxiliary fuels are used or select the appropriate choice from items 2, 3, or 4 if auxiliary fuels are used.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Auxiliary Fuel Usage
1. No auxiliary fuels used
2. Natural gas used
3. #2 fuel oil used
4. #6 fuel oil used
Use numbers or UP/DOWN arrow keys to highlight selection.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: SHOW F3: TEST F9: CALC F10: NEXT PgUp/PgDn: SHOW Alt-F10: END Esc: EXIT

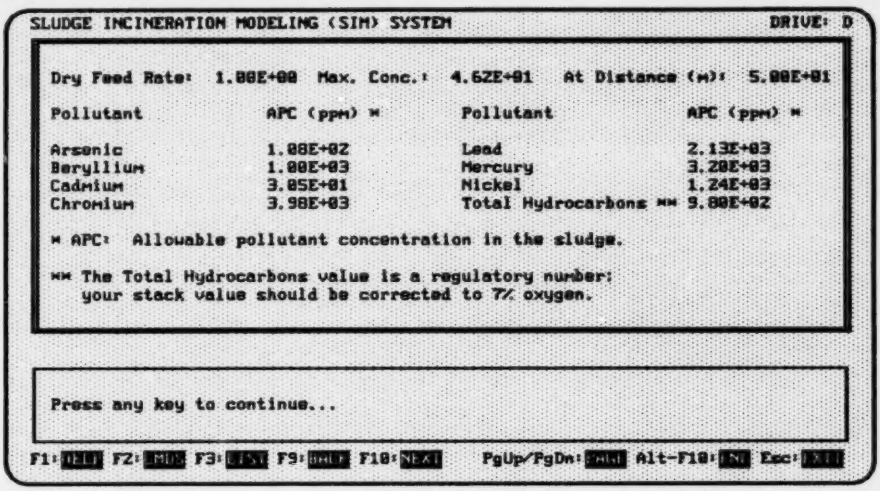
If auxiliary fuels are used, a follow-up screen (as shown below) will ask you for the average daily fuel usage rate. The usage rate is in cubic feet per day for natural gas and pounds per day for fuel oil.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Annual Average Auxiliary Fuel Usage Rate
Daily fuel usage rate (cu ft/day)
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: LIST F9: PRINT F10: NEXT PgUp/PgDn: PREV Alt-F10: ENT Esc: EXIT

The next screen contains two more parameters used in the calculation of the maximum combustion gas flow rate. The annual average volatile solids fraction of the sewage sludge solids is a dimensionless decimal value that should be less than 1.0. The default value is 0.5. The annual average heat value of the volatile solids is in kilocalories per gram of volatile solids in the sewage sludge. The default value is 5.5.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Maximum Combustion Gas Flow Rate Parameters
Average volatile solids fraction
Volatile solids heat value (Kcal/g) 5.5
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: LIST F9: PRINT F10: NEXT PgUp/PgDn: PREV Alt-F10: ENT Esc: EXIT

Next, the results of the SIM post processor are presented on the screen. The example screen below illustrates that the dry feed rate, maximum concentration and distance of maximum concentration are given at the top of each screen and are followed by the estimates of the allowable pollutant concentration in the sludge (ppm) for each pollutant. These results are also written to a post processor output file. The output file name consists of the letters "SLUDGE" followed by a numeric value consistent with the ISCLT model input file. The extension is ".OUT."

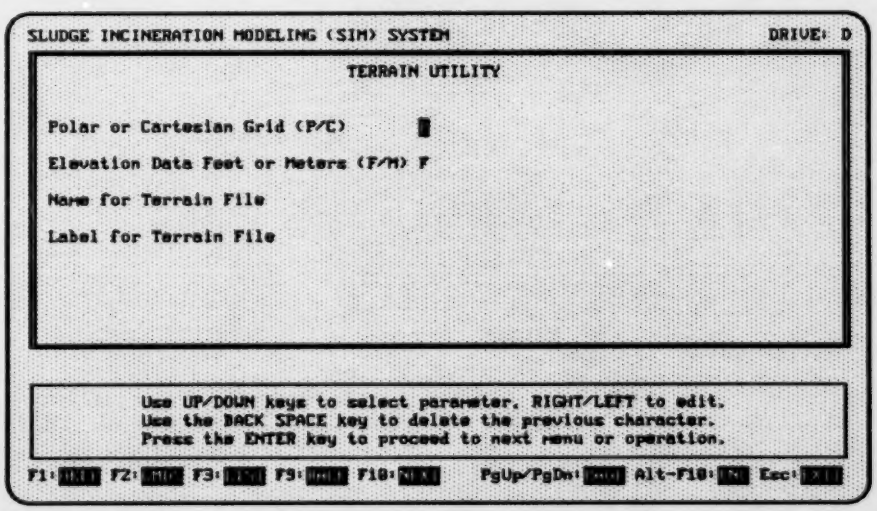

SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Dry Feed Rate: 1.00E+00 Max. Conc.: 4.62E+01 At Distance (m): 5.00E+01
Pollutant APC (ppm) *
Pollutant APC (ppm) *
Arsenic 1.08E+02
Beryllium 1.00E+03
Cadmium 3.05E+01
Chromium 3.98E+03
Lead 2.13E+03
Mercury 3.20E+03
Nickel 1.24E+03
Total Hydrocarbons ** 9.80E+02
* APC: Allowable pollutant concentration in the sludge.
** The Total Hydrocarbons value is a regulatory number:
your stack value should be corrected to 7% oxygen.
Press any key to continue...
F1: HELP F2: MORE F3: FIRST F9: HOME F10: NEXT PgUp/PgDn: SHIFT Alt-F10: END Esc: EXIT

You are then cycled back to the dry feed rate menu where you can either end the post processor by pressing the ALT/F10 function keys or enter in a new dry feed rate and new distance for maximum concentration if applicable.

11. TERRAIN UTILITY

The terrain utility is used to input terrain elevations for each receptor grid to be modeled. This utility need be used only if you want to include terrain in your modeling. After all elevations are entered, the utility creates a file containing all the elevation (Z) values. The name of the file is supplied by you. The file extension ".DAT" is automatically appended by the system. When you use the first component of the system (Build ISCLT Model Input File) and you select terrain, you will be requested to provide the name of the elevations file. This utility must be run prior to the build component if you want to include terrain.

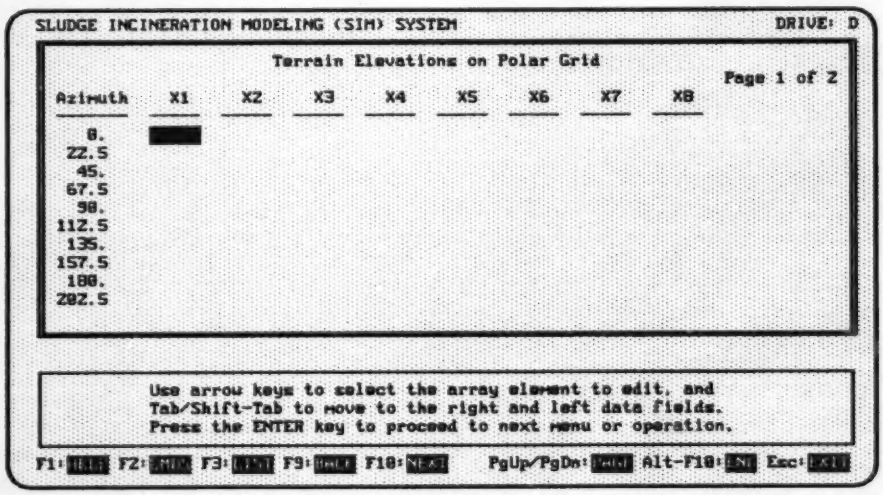
The first screen that appears when you select the terrain utility requires a choice on whether you are going to use a polar or Cartesian receptor grid, and whether the elevations data you are going to enter are in the units of feet or meters. The output file label is also supplied via this menu. The screen shown below is an example of the first terrain utility menu.

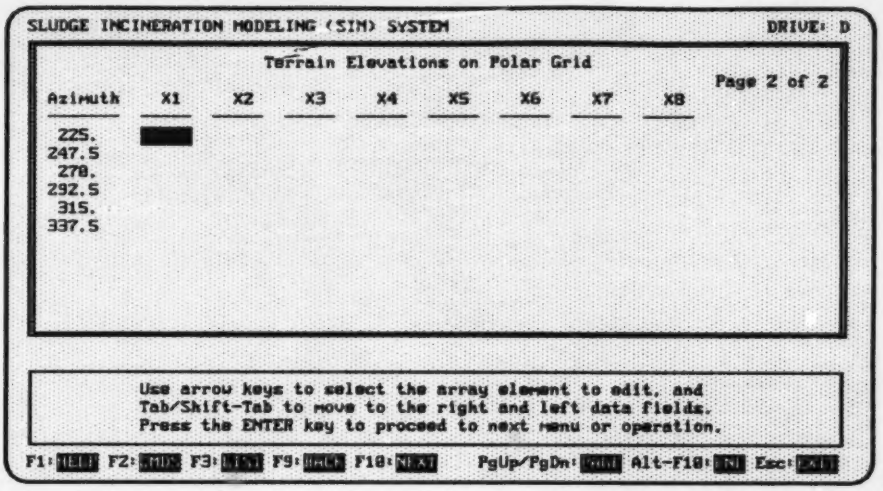


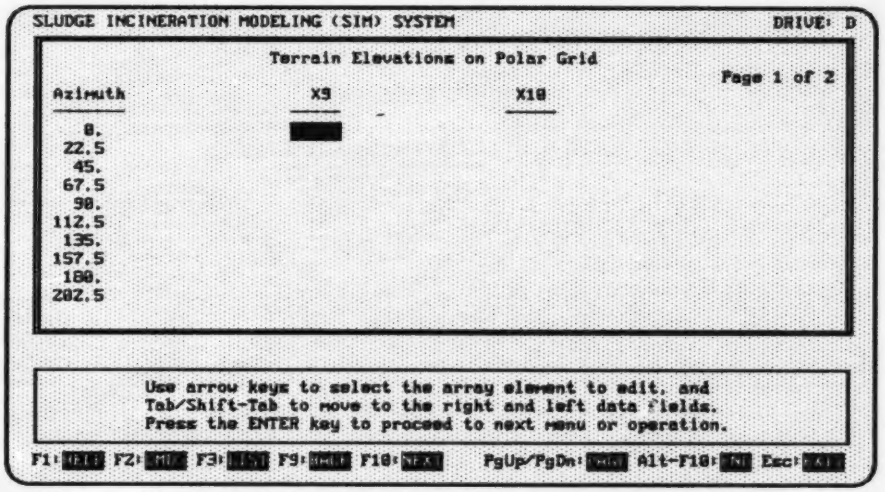
The parameters presented in the second menu depend on whether you are working in a polar or Cartesian receptor grid system. If it is a polar

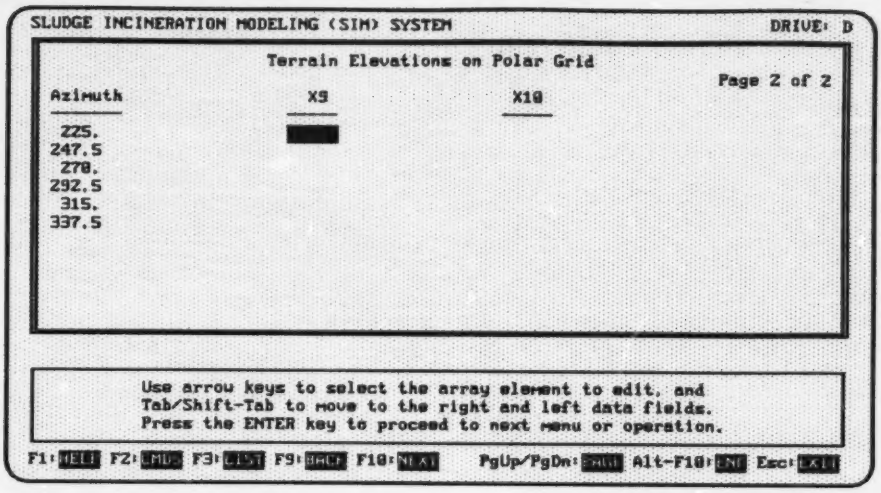
grid system, the number of receptor grid ranges (rings) and the number of receptor grid radials (azimuth bearings) are specified. If it is a Cartesian grid system, the number of east-west X-axis and north-south Y-axis receptor grids are specified.

The terrain elevations above mean sea level at each receptor of the polar or Cartesian grid system are input in the final sets of screens. For a polar grid system, as shown below, the X1, X2, X3... across the top identifies the rings, and the left-hand column identifies the azimuth angles starting at zero degrees (north) and moving clockwise. Up to eight rings appear across the top of the screen. Each set of up to eight rings is identified as a screen or screen set depending on how many azimuth values there are. Up to ten azimuth values appear on each page of a screen set. If you have ten rings and 16 azimuth values, there will be two screen sets each with two pages. The following four screens illustrate how a ten ring with 16 azimuth grid is presented in the terrain utility. Use PgUp and PgDn to move from page to page if the menu is more than one page long. Press ENTER when you are finished with a screen set.

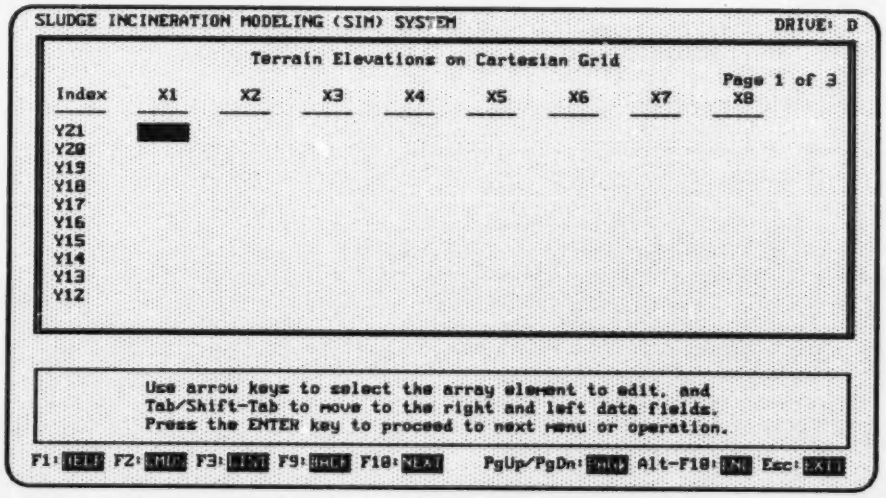



SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Terrain Elevations on Polar Grid
Page 2 of 2
Azimuth
X1
X2
X3
X4
X5
X6
X7
X8
225.
247.5
270.
292.5
315.
337.5
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: SAVE F3: PRINT F9: GRAPH F10: NEXT
PgUp/PgDn: PAGE Alt-F10: INIT Esc: EXIT


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Terrain Elevations on Polar Grid
Page 1 of 2
Azimuth
X9
X10
0.
22.5
45.
67.5
90.
112.5
135.
157.5
180.
202.5
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: SAVE F3: PRINT F9: GRAPH F10: NEXT
PgUp/PgDn: PAGE Alt-F10: INIT Esc: EXIT


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Terrain Elevations on Polar Grid
Page 2 of 2
Azimuth
X9
X10
225.
247.5
270.
292.5
315.
337.5
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: EDIT F9: CALC F10: NEXT PgUp/PgDn: MENU Alt-F10: END Esc: EXIT

If you are using a Cartesian grid in your modeling, the terrain screens will have X1, X2, X3... to identify the X-axis grids and Y1, Y2, Y3.... in the left-hand column to identify the Y-axis grids. Notice in the screen presented below that the Y-axis grids start at the bottom of the column. Again, up to eight X- axis grids appear on each screen set, with up to ten Y-axis grids per page. The ISC model documentation for parameter Z on pages 4-17 and 4-18 presents the data elements graphically for both polar and Cartesian grids.

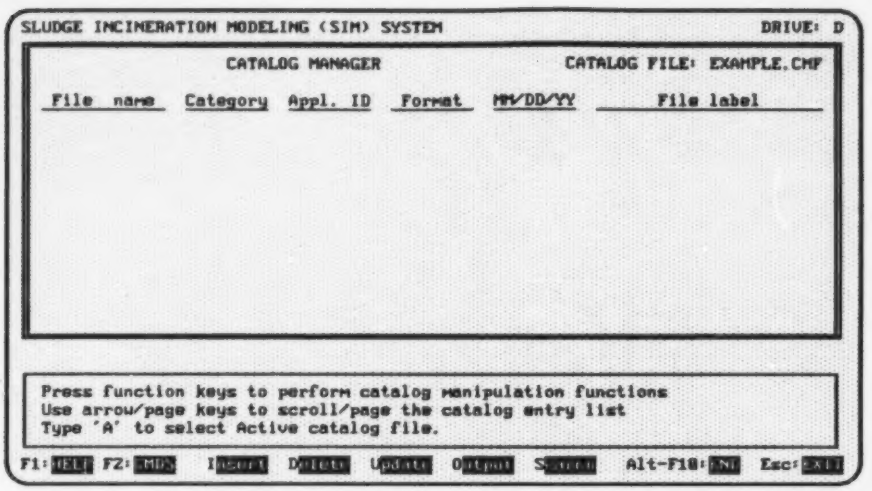


12. RUN CATALOG MANAGER

The catalog manager allows you to maintain and update a listing of all the files that are generated by the system or entered by the user in one or more catalogs. In the course of maintaining this list in the catalog, you are allowed to delete files, update file attributes, send the output from a particular file to the printer or to the PC screen for viewing, or insert files into the catalog listing. You may also switch catalogs at will by entering "A" after entering the F3 function key.

The output files created when you run a program will be inserted into the active catalog, i.e., the catalog file which was most recently selected. If there is no active catalog file in your directory, then you will be prompted to enter a name for a catalog file. The files are then inserted into the new catalog file which becomes the active catalog file. To change the active catalog so that files from a program go into a different catalog file, use the F3 function key to switch default catalog files as explained above **before** you access the particular program or before the processing actually begins. To change the active catalog, enter the F3 function key to bring up the active catalog file. If it is not the one you want, enter "A" and the list of catalog files will be shown, along with the words "NEW" in square brackets. You may select any of the existing catalog files to be the new active catalog file, or you may select a new catalog file by selecting the "[NEW]" option and entering a catalog name.

To access the catalog manager, press the ENTER key when your cursor is over the Run Catalog Manager procedure in the primary navigational menu of the SIM system. The following screen appears.


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
CATALOG MANAGER
CATALOG FILE: EXAMPLE.CMF
File name
Category
Appl. ID
Format
MM/DD/YY
File label
Press function keys to perform catalog manipulation functions
Use arrow/page keys to scroll/page the catalog entry list
Type 'A' to select Active catalog file.
F1: HELP F2: KEYS Insert Delete Update Output Sort Alt-F10: END Esc: EXIT

You are sent directly to the active catalog file which is the file into which file names were last inserted. If you wish to see the list in another catalog file, enter "A". You will see a menu listing all the catalog names, with the active catalog file highlighted, you are then prompted to select one.

The catalog manager has its own set of commands keys separate from the SIM command keys. These keys call up a variety of functions such as printing and deleting files. In addition to the function keys normally used by SIM, such as F1 to obtain help information, and ALT/F10 to end the program, the catalog manager has a set of one-character alphabetical commands that may be entered from the keyboard such as "D" for delete or "I" for insert. The command keys are explained below.

F1 This key provides introductory information on the catalog manager. To see information on specific keys, enter the F2 key.

F2 This key provides a brief description of the command keys.

I This key allows you to insert a file into the active catalog file. The only criterion for entering a file in the catalog list is that the file must be in the same directory as the catalog file. Bring your cursor to the position on the catalog list where you wish to insert the file and enter this key. A menu will appear asking you to enter the filename and attributes. Enter values for all of the prompts. You may change them later using the update function if you so desire.

D This key allows you to delete the file you have highlighted by the cursor from both the catalog file and the directory in which the file resides.

If you select this command, you will see the title of the menu change from "CATALOG MANAGER" to "DELETE CATALOG FILES" indicating that you are in delete mode. To select a file for deletion, place your cursor on the file name and enter the letter "S" form your keyboard. An arrow will appear to the left of the file name indicating that the file has been selected for deletion. You may delete as many files as you wish. When you are through selecting the files that you wish to delete, enter "D" again. You will see a new menu displaying the file names of the files that you chose to delete and asking you to verify whether you really wish to delete the files by entering "Y". Scan the list carefully since the files will be deleted as soon as you enter "Y".

U This key function allows you to update the file which you have selected (highlighted at that moment by the cursor). A menu appears when this function is evoked which displays all the current file attributes. You may change any or all of the attributes. When you are done changing the attributes, press ENTER and you will be returned to the Catalog Manager Menu.

O This function allows you to send the contents of the file you have selected using the cursor either to the PC screen or to a printer. An additional screen will appear when you enter this command listing the output options. If you are sending the output to the PC screen, you must enter the ALT/F10 command after viewing the contents of the file in order to return to Catalog Manager Menu.

The print option in SIM uses the DOS PRINT command to print the file. If you select the print option, the SIM menu screen will be cleared and you will see the familiar DOS print command question on the PC screen if you have not already entered the PRINT command outside the system or selected this option previously:

Name of list device [PRN]:

This allows you to specify the output list device--LPT1, LPT2, LPT3, PRN, COM1, COM2, COM2, etc. The default is PRN and you may, in most cases, accept it by pressing ENTER. **Make sure that your printer in on-line before you select the print option.** The contents of the file is sent to the printer, and you may return to the main catalog manager menu and enter another file to print. The file is put in the print queue. You may repeat this procedure for up to six files. If your printer is not on-line, then SIM will immediately return to the main catalog manager menu. The contents of the file, however, have been sent to the printer buffer and will be printed as soon as you set the printer to on-line.

Once you have entered the list device, you will not see the prompt again in this session.

S This key function will search for files in a large catalog file. It will search only the default catalog file.

ALT/F10 This command allows you to exit the catalog manager.

ESC This function key allows you to exit SIM.

13. EXAMPLE PROBLEM

A. Introduction

The following example describes one case using the SIM system to determine ambient concentrations and pollutant specific allowable concentrations in the sludge being incinerated. All data inputs for this example case are described in the SIM input sequence rather than the typical Industrial Source Complex Long-Term model (ISCLT) sequence. No terrain is included in the example and thus, the TERRAIN UTILITY is not exercised in this example. The following sections provide an example problem and the associated input data; a description of each input variable, its implications, and how its selection or determination should be made; and example input and output file names.

B. Example

A facility in Atlanta, Georgia is proposing to burn sludge in two equally sized incinerators with stacks located approximately 2.5 m (8.2 ft) apart on an east-west line. Emissions will be approximately identical for the two incinerators, i.e., equal feed rates and operating capacities. The facility is required to perform an air quality impact analysis to determine the allowable pollutant concentrations in the sludge. The criteria by which this determination is made includes the ambient air impacts produced by the incinerators, the Risk Specific Concentration (ug/m^3) (see Appendix A, Table A1) determined on the basis of a probability of contracting cancer of $1x10^{-5}$, or 1 in 10^5 persons, and the control efficiencies assumed in the incineration process (see Appendix A, Table A2).

The stack and emission characteristics for the two sources are:

	Source A	Source B
Stack height =	7.6 m	7.6 m
Stack diameter =	0.51 m	0.51 m
Gas exit velocity =	311 K	311 K
X-coordinate =	1.25 m	-1.25 m
Y-coordinate =	0 m	0 m

A nearby building may cause downwash of the effluent as it leaves the stacks thereby leading to potentially higher concentrations downwind. The dimensions of the nearby building for the proposed facility are:

Building height = 5.5 m
Building length = 31.7 m
Building width = 23.5

Following the guidance for Good Engineering Practice (GEP) stack height (EPA-450/4-80-023, July 1981), the stacks were determined to be within 5 times the lesser of the building height or maximum projected building width (5.5 m times 5 equals 27.5 m in this case). Thus, downwash should be considered in the analysis. The maximum projected building width was determined to be the diagonal of the building and was further adjusted via the procedures described in the "Regional Workshops on Air Quality Modeling: A Summary Report" (EPA-450/4-82-015, October 1983) to account for the fact that the ISCLT Model (and therefore, the SIM system model) equates a cylindrical area building to the actual source structure. To determine the adjusted building width input to SIM the following equation was used:

$$A = \pi \, d^2/4 = BW^2$$

where

A = area of a cylindrical building
d = the maximum projected width for the example case

In the current case the width of the building (BW) was calculated to be approximately 35.0 m which was used in subsequent analysis.

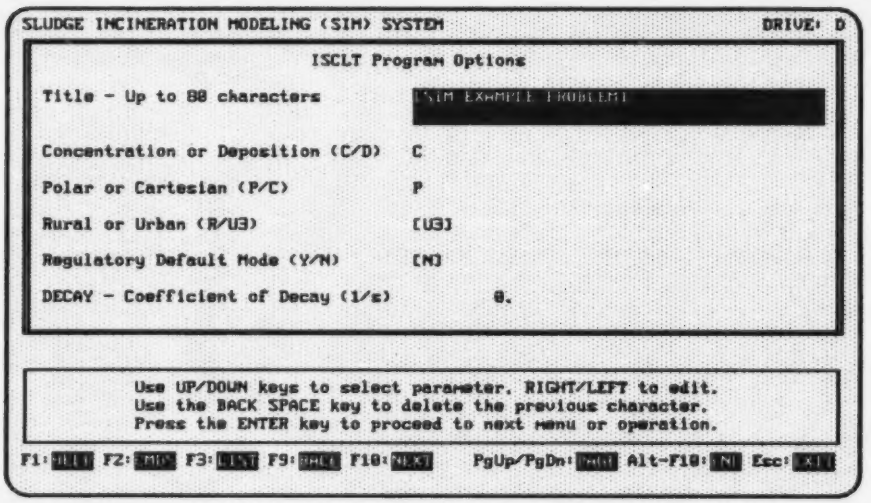
C. Selection of SIM INPUTS

The following screens represent the input required for the example case. The user should be careful to select the recommended values to insure proper comparison to the test case. To help the user diffrentiate between default values that may be assumed and the values that must be entered for this example case, all values that have to be entered by the user in Parameter Editing Menus are highlighted while all selections

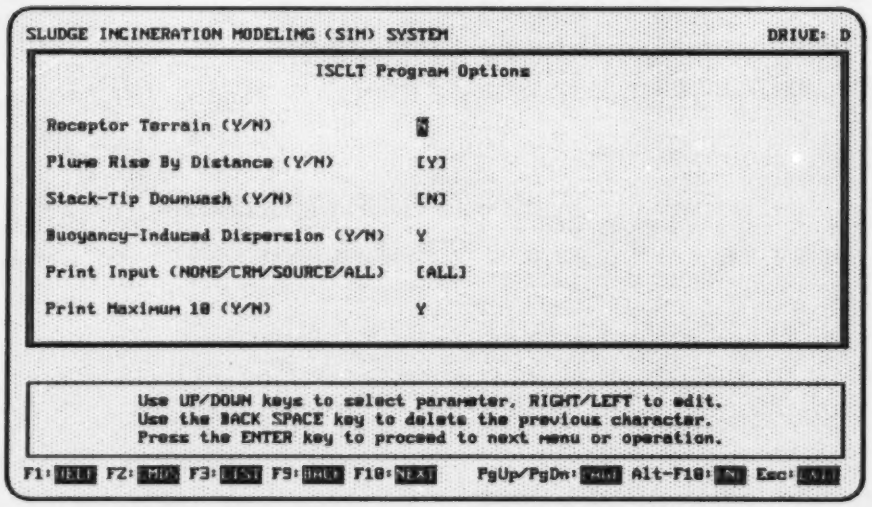
that are to be made in Navigational Menus are highlighted (If you are unfamiliar with the difference between Parameter Editing Menus and Navigational Menus, refer to Section 4B). All variables and screens are presented in the order they appear in SIM. To access items that are highlighted in Navigational Menus, you must position your cursor over the item and press the ENTER key. Inputs will be described more fully in Section D.

Build ISCLT Input File

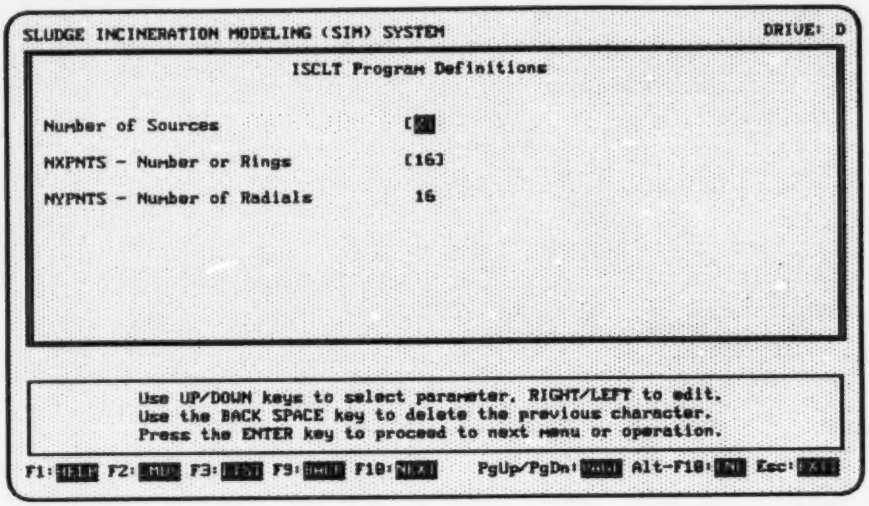
Screen 1


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
ISCLT Program Options
Title - Up to 88 characters
SIM EXAMPLE PROBLEM1
Concentration or Deposition (C/D) C
Polar or Cartesian (P/C) P
Rural or Urban (R/U3) [U3]
Regulatory Default Mode (Y/N) [N]
DECAY - Coefficient of Decay (1/s) 0.
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: LIST F9: RMEN F10: NEXT PgUp/PgDn: PAGE Alt-F10: INI Esc: EXIT

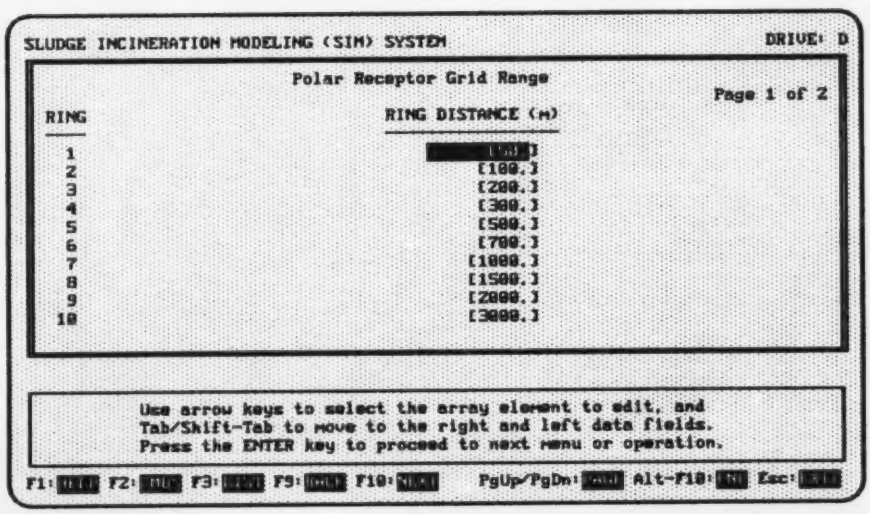
Screen 2

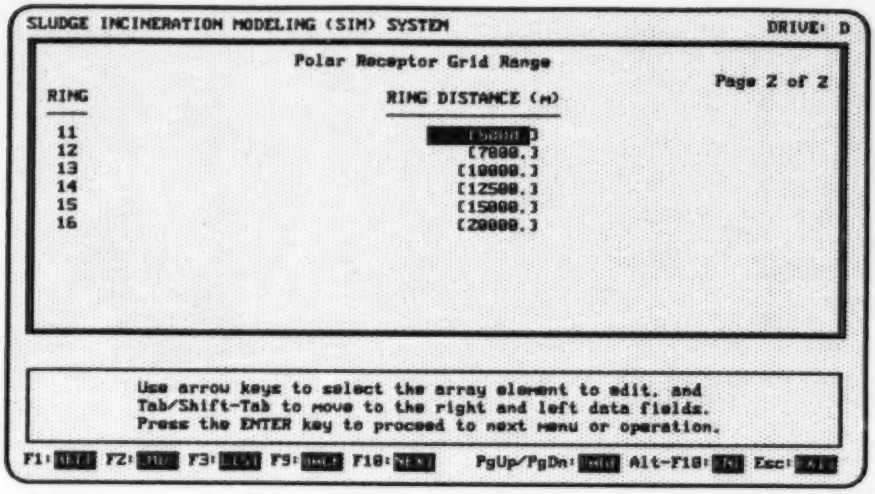

SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
ISCLT Program Options
Receptor Terrain (Y/N) N
Plume Rise By Distance (Y/N) [Y]
Stack-Tip Downwash (Y/N) [N]
Buoyancy-Induced Dispersion (Y/N) Y
Print Input (NONE/CRM/SOURCE/ALL) [ALL]
Print Maximum 10 (Y/N) Y
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: LIST F9: RMEN F10: NEXT PgUp/PgDn: PAGE Alt-F10: INI Esc: EXIT

Screen 3

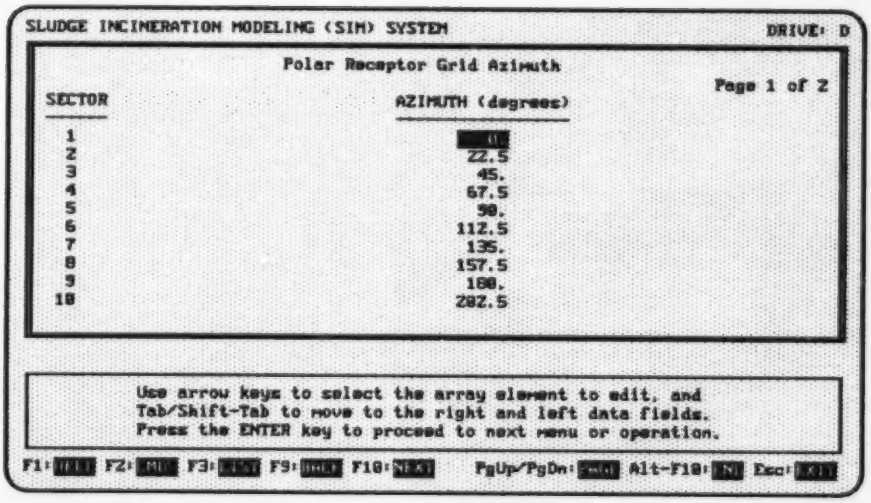

SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
ISCLT Program Definitions
Number of Sources [2]
NXPNTS - Number or Rings [16]
NYPNTS - Number of Radials 16
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MAIN F3: PREV F9: CALC F10: NEXT PgUp/PgDn: PAGE Alt-F10: INI Esc: EXIT

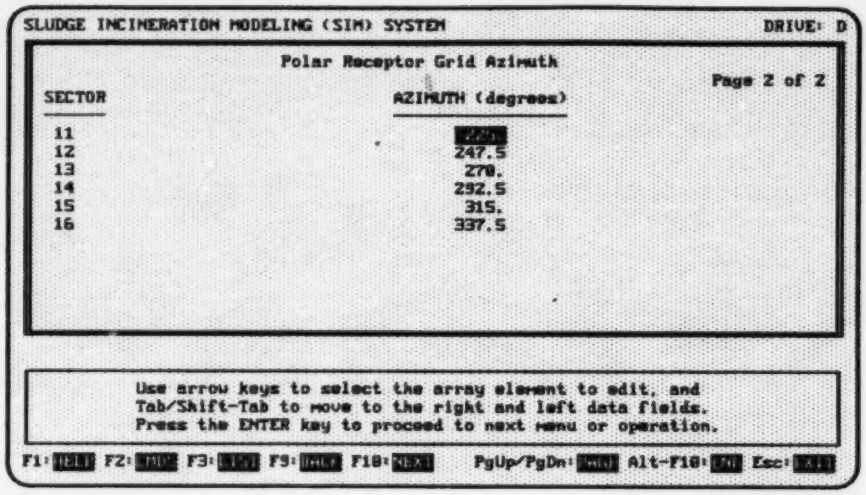
Screens 4-5


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Polar Receptor Grid Range
Page 1 of 2
RING
RING DISTANCE (m)
1 [50.]
2 [100.]
3 [200.]
4 [300.]
5 [500.]
6 [700.]
7 [1000.]
8 [1500.]
9 [2000.]
10 [3000.]
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MAIN F3: PREV F9: CALC F10: NEXT PgUp/PgDn: PAGE Alt-F10: INI Esc: EXIT

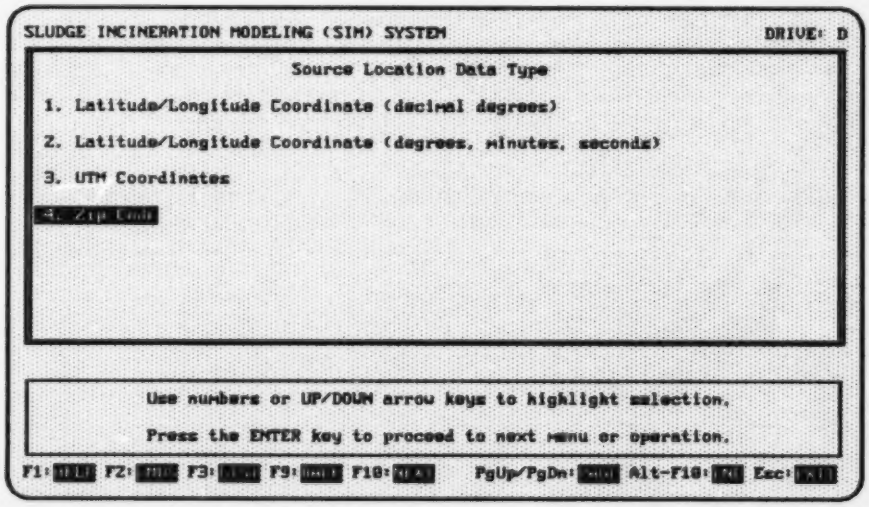

SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Polar Receptor Grid Range
Page 2 of 2
RING
RING DISTANCE (m)
11 [5000.]
12 [7000.]
13 [10000.]
14 [12500.]
15 [15000.]
16 [20000.]
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: PRINT F9: UNDO F10: NEXT PgUp/PgDn: SCROLL Alt-F10: INIT Esc: EXIT

Screens 6-7

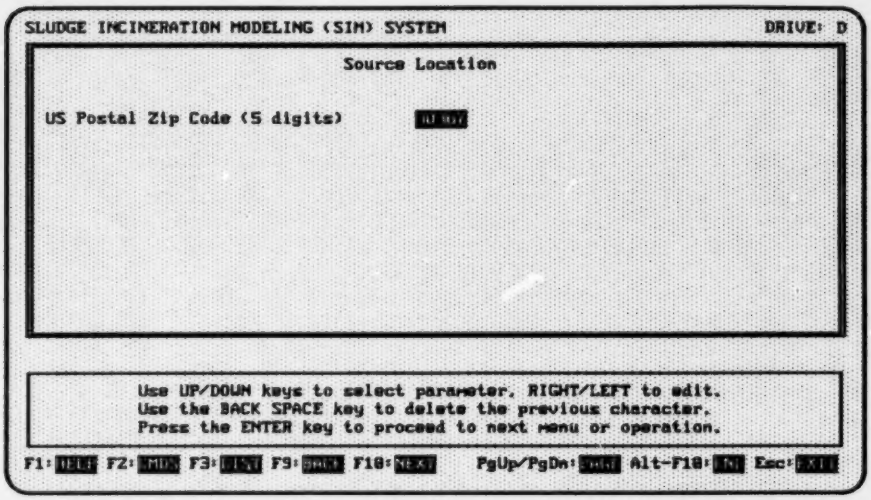

SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Polar Receptor Grid Azimuth
Page 1 of 2
SECTOR
AZIMUTH (degrees)
1 0.
2 22.5
3 45.
4 67.5
5 90.
6 112.5
7 135.
8 157.5
9 180.
10 202.5
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: PRINT F9: UNDO F10: NEXT PgUp/PgDn: SCROLL Alt-F10: INIT Esc: EXIT


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Polar Receptor Grid Azimuth
Page 2 of 2
SECTOR
AZIMUTH (degrees)
11
12 247.5
13 270.
14 292.5
15 315.
16 337.5
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: SAVE F3: PRINT F9: UNDO F10: NEXT PgUp/PgDn: PAGE Alt-F10: END Esc: EXIT

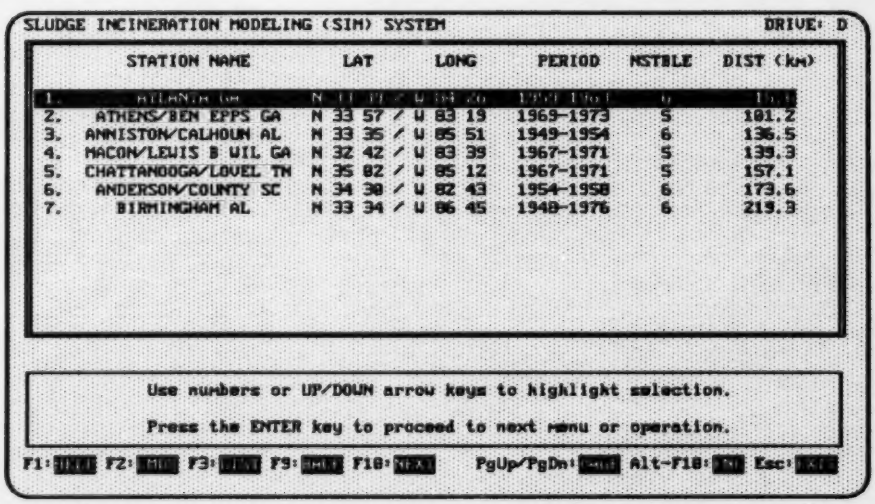
Screen 8


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Source Location Data Type
1. Latitude/Longitude Coordinate (decimal degrees)
2. Latitude/Longitude Coordinate (degrees, minutes, seconds)
3. UTM Coordinates
4. Zip Code
Use numbers or UP/DOWN arrow keys to highlight selection.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: SAVE F3: PRINT F9: UNDO F10: NEXT PgUp/PgDn: PAGE Alt-F10: END Esc: EXIT

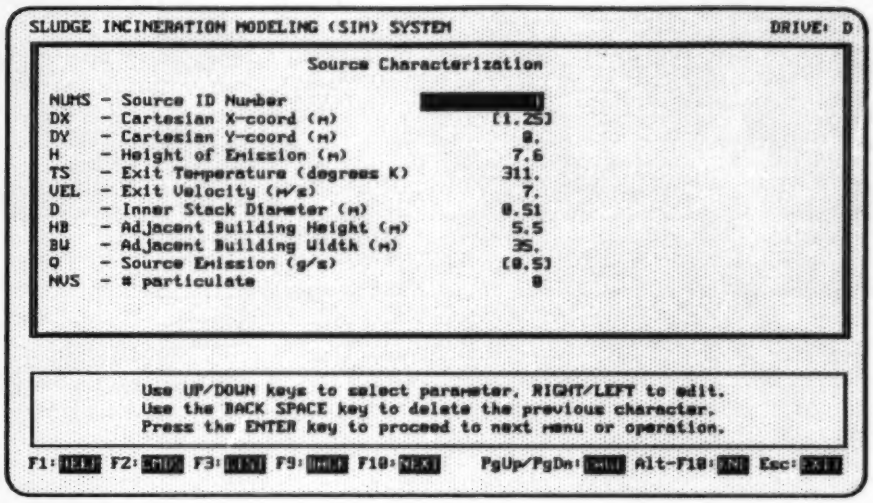
Screen 9


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Source Location
US Postal Zip Code (5 digits)
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: PRINT F9: SMILE F10: NEXT PgUp/PgDn: SMILE Alt-F10: INI Esc: EXIT

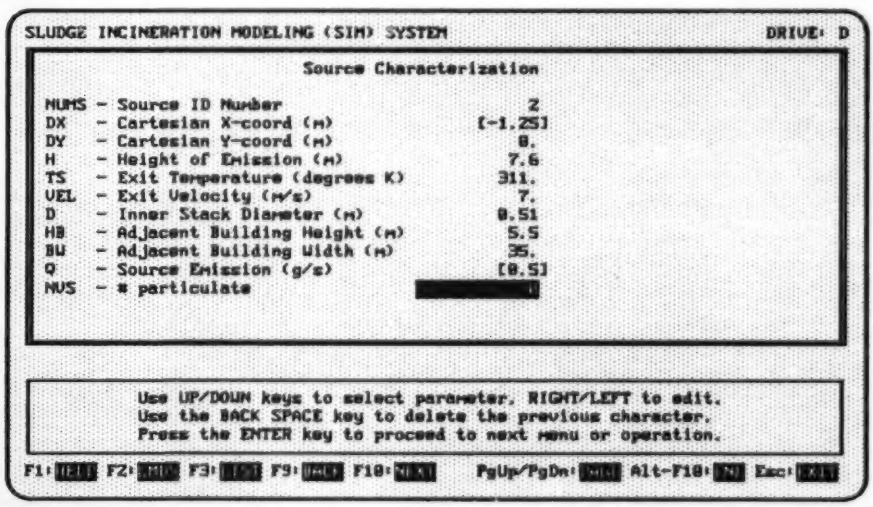
Screen 10


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
STATION NAME LAT LONG PERIOD MSTBLE DIST (km)
2. ATHENS/BEN EPPS GA N 33 57 / W 83 19 1969-1973 S 101.2
3. ANNISTON/CALHOUN AL N 33 35 / W 85 51 1949-1954 6 136.5
4. MACON/LEWIS B WIL GA N 32 42 / W 83 39 1967-1971 S 139.3
5. CHATTANOOGA/LOVEL TN N 35 02 / W 85 12 1967-1971 S 157.1
6. ANDERSON/COUNTY SC N 34 30 / W 82 43 1954-1958 6 173.6
7. BIRMINGHAM AL N 33 34 / W 86 45 1948-1976 6 215.3
Use numbers or UP/DOWN arrow keys to highlight selection.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MENU F3: PRINT F9: SMILE F10: NEXT PgUp/PgDn: SMILE Alt-F10: INI Esc: EXIT

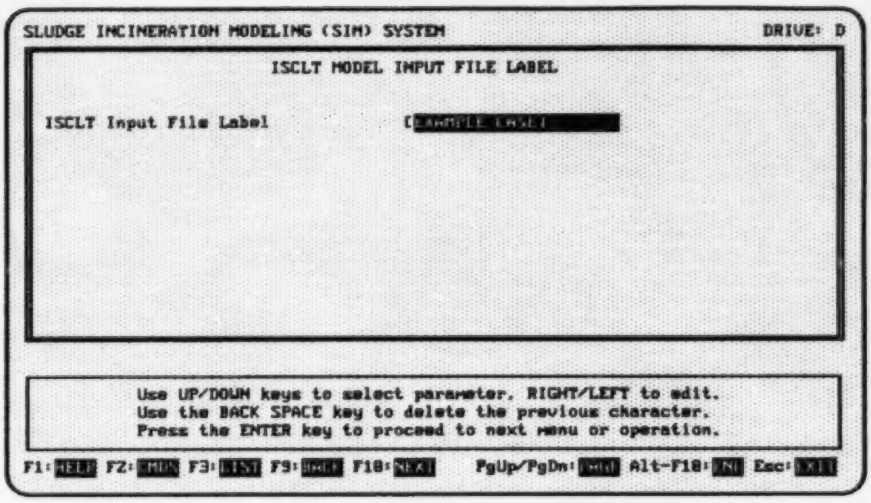
Screen 11


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Source Characterization
NUMS - Source ID Number 1
DX - Cartesian X-coord (m) [1.25]
DY - Cartesian Y-coord (m) 0.
H - Height of Emission (m) 7.6
TS - Exit Temperature (degrees K) 311.
VEL - Exit Velocity (m/s) 7.
D - Inner Stack Diameter (m) 0.51
HB - Adjacent Building Height (m) 5.5
BW - Adjacent Building Width (m) 35.
Q - Source Emission (g/s) [0.5]
NVS - # particulate 0
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: ENTER F3: NEXT F9: UNDO F10: NEXT PgUp/PgDn: SAVE Alt-F10: END Esc: EXIT

Screen 12


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Source Characterization
NUMS - Source ID Number 2
DX - Cartesian X-coord (m) [-1.25]
DY - Cartesian Y-coord (m) 0.
H - Height of Emission (m) 7.6
TS - Exit Temperature (degrees K) 311.
VEL - Exit Velocity (m/s) 7.
D - Inner Stack Diameter (m) 0.51
HB - Adjacent Building Height (m) 5.5
BW - Adjacent Building Width (m) 35.
Q - Source Emission (g/s) [0.5]
NVS - # particulate 0
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: ENTER F3: NEXT F9: UNDO F10: NEXT PgUp/PgDn: SAVE Alt-F10: END Esc: EXIT

Screen 13


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
ISCLT MODEL INPUT FILE LABEL
ISCLT Input File Label
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MAIN F3: LIST F9: BACK F10: NEXT PgUp/PgDn: MOVE Alt-F10: END Esc: EXIT

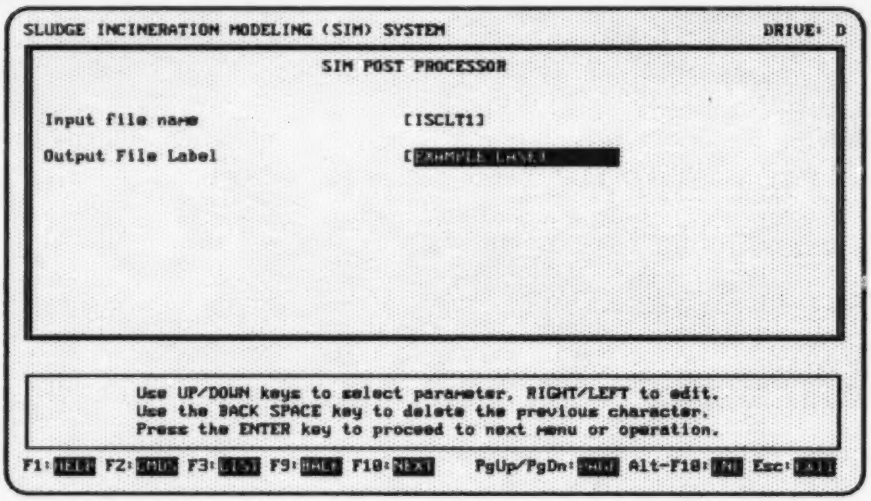
Pressing the ENTER key returns the user to the main menu where Selection No. 2 should be made, i.e., Run ISCLT. The SIM system will now prompt the user for an input file name which the user should input to be consistent with that assigned by the BUILD ISCLT INPUT FILE option. When the Run ISCLT option completes its run the user is returned once again to the main menu. The user should now select item No. 3, i.e., SIM Post Processor. Two output files were generated by the ISCLT run. There is a regular ISCLT output file, (File Name).OUT and a special output file for post processing, (File Name).PP. The Post Processor requests this (File Name).PP file which is used subsequently to calculate the allowable pollutant concentrations in the sludge. The Post Processor operates on the principle that ambient concentrations, emissions, and sludge concentrations are all directly proportional to each other. This allows the backcalculation of an allowable sludge concentration given the ambient impact of the proposed facility, x_p, the incremental target concentration for an individual chemical, x_t (Appendix A, Table 1), and the unit emission rate, Q_o, of 1.0 g/s. This is summarized by the simple relationship:

$$\frac{x_t}{x_p} = \frac{Q_a}{Q_o}$$

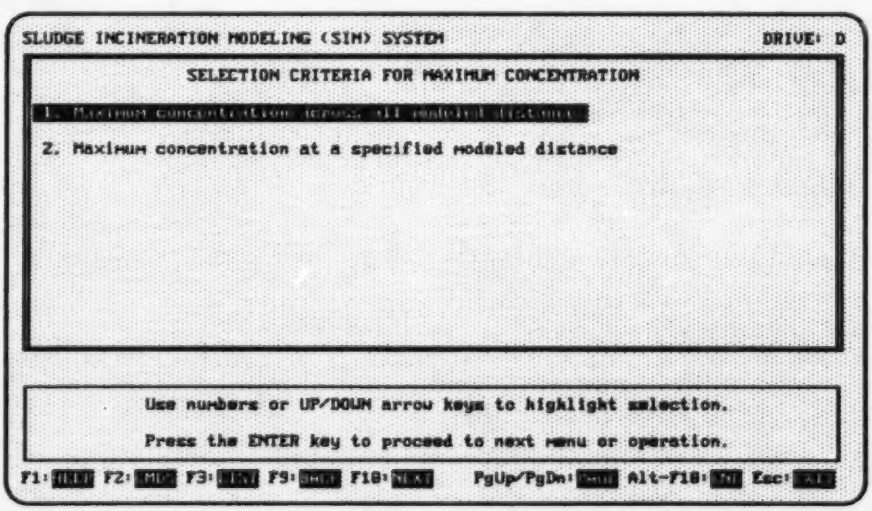
Where Q_a is the allowable emission rate. The allowable emission rate is used together with the assumed control efficiency of the incinerator and the dry feed rate to arrive to an allowable sludge concentration for each chemical constituent. The SIM Post Processor completes this calculation. For this example the user should select items per the following:

SIM Post Processor

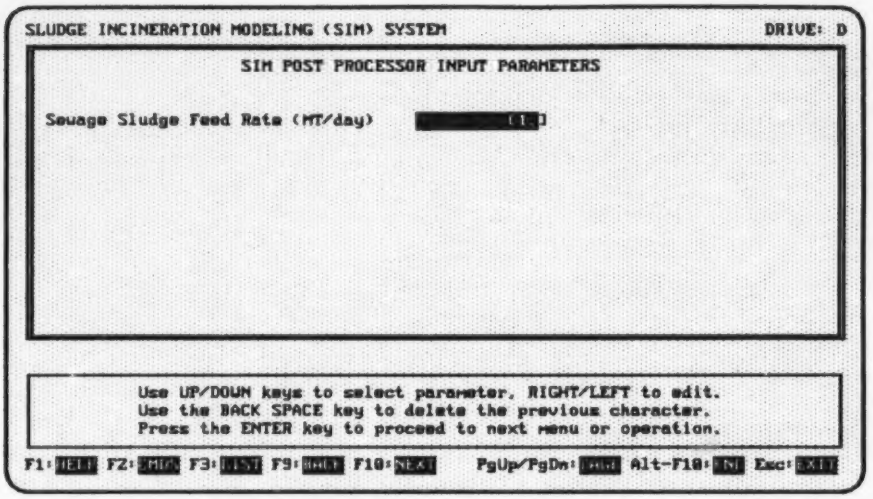
Screen 1


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
SIM POST PROCESSOR
Input file name
[ISCLT1]
Output File Label
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MOD F3: LIST F9: SMLY F10: NEXT PgUp/PgDn: SHIFT Alt-F10: MAIN Esc: EXIT

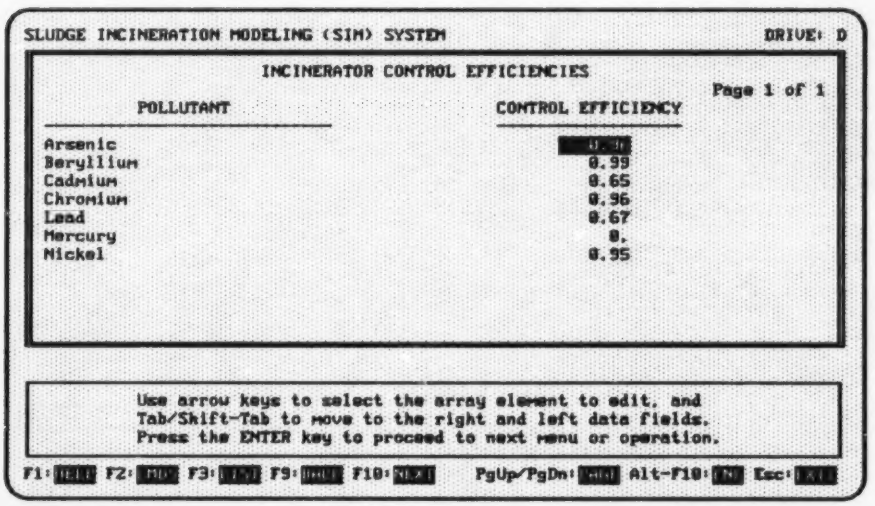
Screen 2


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
SELECTION CRITERIA FOR MAXIMUM CONCENTRATION
2. Maximum concentration at a specified modeled distance
Use numbers or UP/DOWN arrow keys to highlight selection.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MOD F3: REV F9: SMLY F10: NEXT PgUp/PgDn: SHIFT Alt-F10: MAIN Esc: EXIT

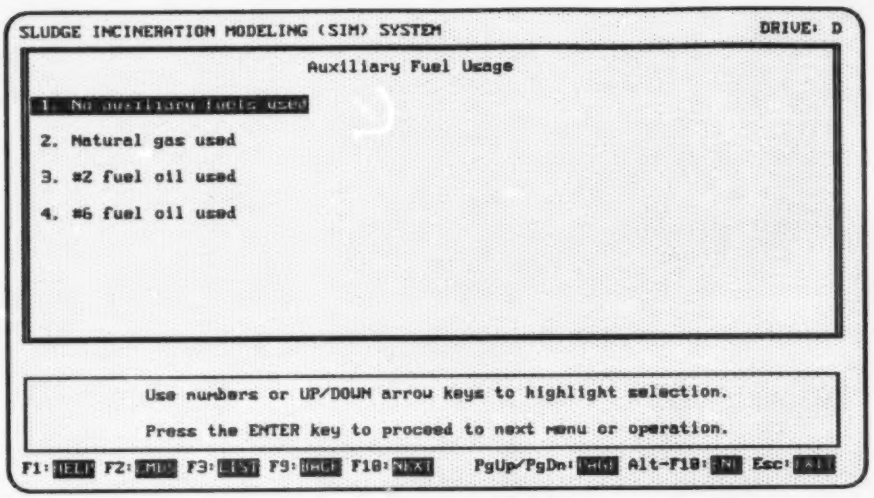
Screen 3


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
SIM POST PROCESSOR INPUT PARAMETERS
Sewage Sludge Feed Rate (MT/day)
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MOD F3: LIST F9: CALC F10: NEXT PgUp/PgDn: MOD Alt-F10: INI Esc: EXIT

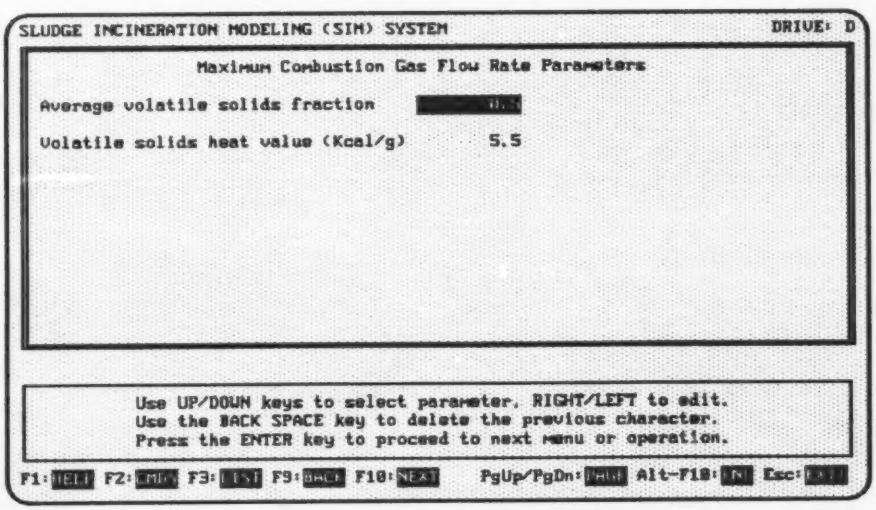
Screen 4


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
INCINERATOR CONTROL EFFICIENCIES
Page 1 of 1
POLLUTANT
CONTROL EFFICIENCY
Arsenic
Beryllium 0.99
Cadmium 0.65
Chromium 0.96
Lead 0.67
Mercury 0.
Nickel 0.95
Use arrow keys to select the array element to edit, and
Tab/Shift-Tab to move to the right and left data fields.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: MOD F3: LIST F9: CALC F10: NEXT PgUp/PgDn: MOD Alt-F10: INI Esc: EXIT

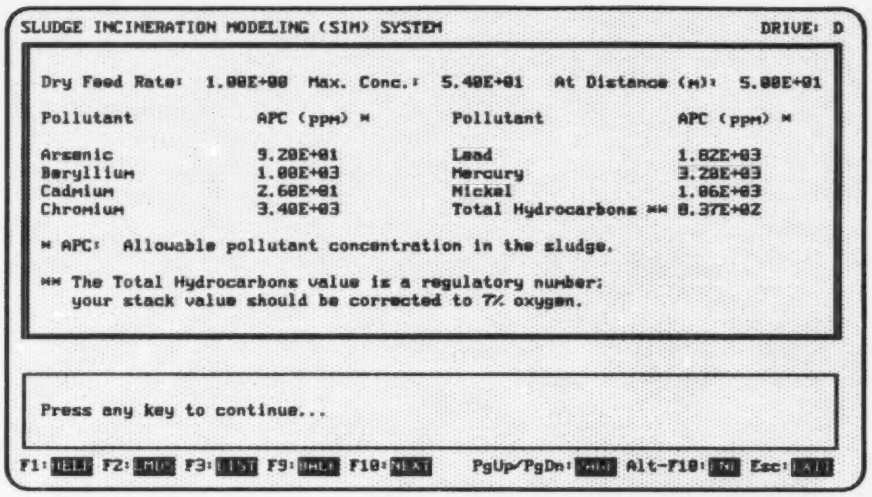
Screen 5


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Auxiliary Fuel Usage
1. No auxiliary fuels used
2. Natural gas used
3. #2 fuel oil used
4. #6 fuel oil used
Use numbers or UP/DOWN arrow keys to highlight selection.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: SMIS F3: LIST F9: BACK F10: NEXT PgUp/PgDn: PAGE Alt-F10: INI Esc: EXIT

Screen 6


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Maximum Combustion Gas Flow Rate Parameters
Average volatile solids fraction
Volatile solids heat value (Kcal/g) 5.5
Use UP/DOWN keys to select parameter, RIGHT/LEFT to edit.
Use the BACK SPACE key to delete the previous character.
Press the ENTER key to proceed to next menu or operation.
F1: HELP F2: SMIS F3: LIST F9: BACK F10: NEXT PgUp/PgDn: PAGE Alt-F10: INI Esc: EXIT

Screen 7


SLUDGE INCINERATION MODELING (SIM) SYSTEM
DRIVE: D
Dry Feed Rate: 1.00E+00 Max. Conc.: 5.40E+01 At Distance (m): 5.00E+01
Pollutant APC (ppm) * Pollutant APC (ppm) *
Arsenic 9.20E+01 Lead 1.82E+03
Beryllium 1.00E+03 Mercury 3.20E+03
Cadmium 2.60E+01 Nickel 1.06E+03
Chromium 3.40E+03 Total Hydrocarbons ** 8.37E+02
* APC: Allowable pollutant concentration in the sludge.
** The Total Hydrocarbons value is a regulatory number;
your stack value should be corrected to 7% oxygen.
Press any key to continue...
F1: HELP F2: MENU F3: LIST F9: SHELL F10: NEXT PgUp/PgDn: VIEW Alt-F10: END Esc: EXIT

D. Input Option Selection Criteria

This section presents guidance on the selection of input variables. Recommended selections for best SIM operation are generally given.

BUILD ISCLT INPUT FILE

Screen 1

Title - user option

Concentration or Deposition - for most applications the user should select the "concentration" option which estimates ambient air levels; "deposition" will not work with the SIM Post Processor.

Polar or Cartesian - the user should select the grid of coordinates which suits their needs or with which they are more comfortable.

Rural or Urban - The rural/urban option specifies whether the rural dispersion mode or an urban dispersion mode is to be used. The decision on which of the rural or urban modes to use should be selected on the basis of a land use classification or a population based procedure. Generally, the area within a 3 km radius of the facility is considered. The procedures discussed in the "Guideline on Air Quality Models (Revised)" (EPA-450/2-78- 027R, July 1986) should be used as guidance to selection. The Rural Mode should be used for rural applications and Urban Mode 3 for urban applications. Note that the use of Urban Modes 1 and 2 are not implemented as per recommendation by EPA.

Regulatory Default Mode - If selected, this option automatically redefines some user input options and selects others. The following features are incorporated when this option is selected:

a) final plume rise (not recommended if downwash required)
b) stack-top downwash included (not recommended if downwash required)
c) buoyancy-induced dispersion
d) default wind profile coefficients
e) default vertical potential temperature gradients
f) half-life decay of 4 hours for SO_2, zero for all else.

If downwash analysis is required this item should be set to no regulatory default mode.

Decay coefficient - generally set equal to 0.

Screen 2

Terrain Receptors - this should be used if terrain around a facility is at or greater than stack height; otherwise select the no terrain option.

SO_2 Modeling - select only if SO_2 is being modeled

Print Input - user option; generally select all

Print Maximum 10 - user option, not needed for SIM Post Processor.

Screen 3

Number of Sources - enter the number of individual stacks to be analyzed simultaneously in a given analysis.

NXPNTS - user option; this value indicates either the number of X-ranges in a rectangular coordinate system or the number of downwind distances (rings) for a polar coordinate system; generally, the X-distances should start at the property boundaries; to ensure the determination of the maximum concentration several iterations of the SIM Program using variable receptor distances and spacings can be made; default = 21 for rectangular, and 10 for polar.

NYPNTS - user option; this value indicates either the number of Y-ranges in a rectangular coordinate system or the number of radials (directions) in a polar coordinate system; default = 21 for rectangular and 16 for polar.

Screens 4-5

Ring distances or X-ranges selected by user for receptor grid.

Screens 6-7

Sectors (azimuth angles) or Y-ranges selected by user for receptor grid.

Screen 8

Here the user must select the most convenient way of identifying the subject source facility location for the purpose of picking the closest site of meteorological data; generally this option should be selected on the basis of the most readily available location information.

Screen 9

Enter the appropriate inputs per the Screen 8 selection.

Screen 10

The user will usually select the closest site of meteorological data to the facility. If the meteorological data site representativeness is questionable (e.g., lakeside data for an inland facility), a meteorologist should be consulted.

Screen 12

All values except DX and DY are self-explanatory and BW has been discussed in the example text. If performing a SIM Post Processor analysis, the sum of all Q should equal 1.0 for all sources in a given analysis. DX and DY (in meters) should be in terms of all other coordinate points in the rectangular grid and should be with respect to the center (0,0) of a polar coordinate grid.

SIM POST PROCESSOR

For the SIM post Processor only Screens 2-4 require further discussion.

Screen 2

The maximum concentration at all receptors in the modeled grid should be chosen to determine the most restrictive sludge concentration limits; if a specific downwind distance is desired for determination, the second option should be selected.

Screen 3

Enter the dry feed rate of the sludge in MT/day.

Screens 4

Default control efficiencies should generally be selected unless the user has access to source/sludge incinerator specific efficiencies for individual chemicals.

APPENDIX A

503.63 Incineration - pollutant limits.

(a) Sewage sludge may be fired in an incinerator only if the sewage sludge does not exceed the pollutant limit for beryllium in 503.63(b); the pollutant limit for mercury in 503.63(c); the pollutant limit for lead in 503.63(d); the pollutant limits for arsenic, cadmium, chromium, and nickel in 503.63(e); and the pollutant limit for total hydrocarbons in 503.63(f).

(b) Beryllium

National limit - beryllium.

The maximum allowable concentration of beryllium shall be calculated using equation (1).

$$c = \frac{10}{(1\text{-}CE) \times SF} \qquad (1)$$

Where:

C = Maximum allowable beryllium concentration in sewage sludge, in milligrams per kilogram (dry weight basis).

CE = Sewage sludge incinerator control efficiency (from Table A1).

SF = Sewage sludge feed rate, in metric tons per day (dry weight basis).

(c) Mercury

National limit - mercury

The maximum allowable concentration of mercury shall be calculated using equation (2).

$$c = \frac{3200}{(1\text{-}CE) \times SF} \qquad (2)$$

Where:

C = Maximum allowable concentration of mercury in sewage sludge, in milligrams per kilogram (dry weight basis).

CE = Sewage sludge incinerator control efficiency (from Table A1).

SF = Sewage sludge feed rate in metric tons per day (dry weight basis).

(d) Lead

National limit - lead

The maximum allowable concentration of lead incinerated shall be calculated using equation (3).

$$c = \frac{.25\ (NAAQS) \times 86{,}400}{DF \times (1\text{-}CE) \times SF} \qquad (3)$$

Where:

C = Maximum allowable concentration of lead in sewage sludge, in milligrams per kilogram (dry weight basis).

NAAQS = National Ambient Air Quality Standard for lead (1.5 micrograms per cubic meter maximum arithmetic mean averaged over a calendar quarter).

86,400 = Number of seconds in a day.

DF = Dispersion factor, in micrograms per cubic meter, per gram, per second (from ISCLT results).

CE = Sewage sludge incinerator control efficiency (from Table A1).

SF = Sewage sludge feed rate, in metric tons per day (dry weight basis).

(e) Arsenic, cadmium, chromium, and nickel.

National limit - arsenic, cadmium, chromium, and nickel

The maximum allowable concentration of arsenic, cadmium, chromium, or nickel shall be calculated using equation (4).

$$c = \frac{RSC \times 86{,}400}{DF \times (1\text{-}CE) \times SF} \qquad (4)$$

Where:

C = Maximum allowable concentration of arsenic, cadmium, chromium, or nickel in sewage sludge, in milligrams per kilogram (dry weight basis).

CE = Sewage sludge incinerator control efficiency (from Table A1).

DF = Dispersion factor, in micrograms per cubic meter, per gram, per second (from ISCLT results).

RSC = Risk specific concentration, in micrograms per cubic meter (from Table A2).

86,400 = Number of seconds in a day.

SF = Sewage sludge feed rate, in metric tons per day (dry weight basis).

(f) Total hydrocarbons.

National limit - total hydrocarbons.

The maximum allowable concentration of total hydrocarbons shall be calculated using equation (5).

$$THC = \frac{RSC \times 3{,}240{,}000{,}000}{DF \times GF} \quad (5)$$

Where:

THC = Maximum allowable concentration of total hydrocarbons in the sewage sludge incinerator's emissions, in parts per million, on a volumetric basis, corrected for seven percent oxygen (dry basis).

RSC = Risk specific concentration, in micrograms per cubic meter (from Table A2).

3,240,000,000 = Conversion factors.

DF = Dispersion factor, in micrograms per cubic meter, per gram, per second (from ISCLT results).

GF = Maximum combustion gas flow rate from the sewage sludge incinerator, in gram moles per day.

The concentration of total hydrocarbons measured in the emissions shall be corrected to 50 percent excess air (seven percent oxygen), zero percent moisture as shown in equation (6).

$$\text{Correction factor (dimensionless)} = \frac{14}{(21 - Y)} \quad (6)$$

Where:

Y = Oxygen concentration in the sewage sludge incinerator exit gas (default of 7 percent).

Equation (5) in 503.63(f) is used to calculate the pollutant limit for total hydrocarbons for a sewage sludge incinerator. The following procedure is used to determine the maximum combustion gas flow rate (GF) used in that equation.

Procedure:

1. Calculate the maximum combustion gas flow rate for the sewage sludge incinerator attributable to the combustible portion of the sewage sludge using equation (7).

$$SGF = SF \times VF \times VEHC \times 70{,}100 \quad (7)$$

Where:

SGF = Maximum combustion gas flow rate attributable to the combustible portion of the sewage sludge, in gram moles per day.

SF = Annual average daily sewage sludge feed rate, in metric tons per day (dry weight basis).

VF = Annual average volatile solids fraction of the sewage sludge solids (dimensionless, less than 1.0).

VEHC = Annual average heat value of the volatile solids in sewage sludge, in kilocalories per gram of volatile solids in sewage sludge.

2. Calculate the gas flow rates from the combustion of all auxiliary fuels in the sewage sludge incinerator using equation (8).

$$FGF = FR \times FC \quad (8)$$

Where:

FGF = Fuel combustion gas flow rate, in gram moles per day.

FR = Annual average daily fuel usage rate, in either pounds per day or cubic feet per day.

FC = Fuel constant:

natural gas - 17.69

#2 fuel oil - 324.8

#6 fuel oil - 309.7

3. The maximum combustion gas flow rate (GF) used in equation (5) in 503.63(f) is the sum of the maximum combustion flow rate attributable to the combustible portion of the sewage sludge (SGF) and the fuel combustion gas flow-rate (FGF).

$$GF = SGF + FGF \qquad (9)$$

TABLE A1. INCINERATOR CONTROL EFFICIENCIES

POLLUTANT	CONTROL EFFICIENCIES
Arsenic	0.96
Beryllium	0.99
Cadmium	0.65
Chromium	0.96
Lead	0.67
Mercury	0.00
Nickel	0.95

TABLE A2. RISK SPECIFIC CONCENTRATION

POLLUTANT	RSC (Micrograms per cubic meter)
Arsenic	0.0023
Cadmium	0.0057
Chromium	0.085
Nickel	0.033
Total Hydrocarbons	2.69